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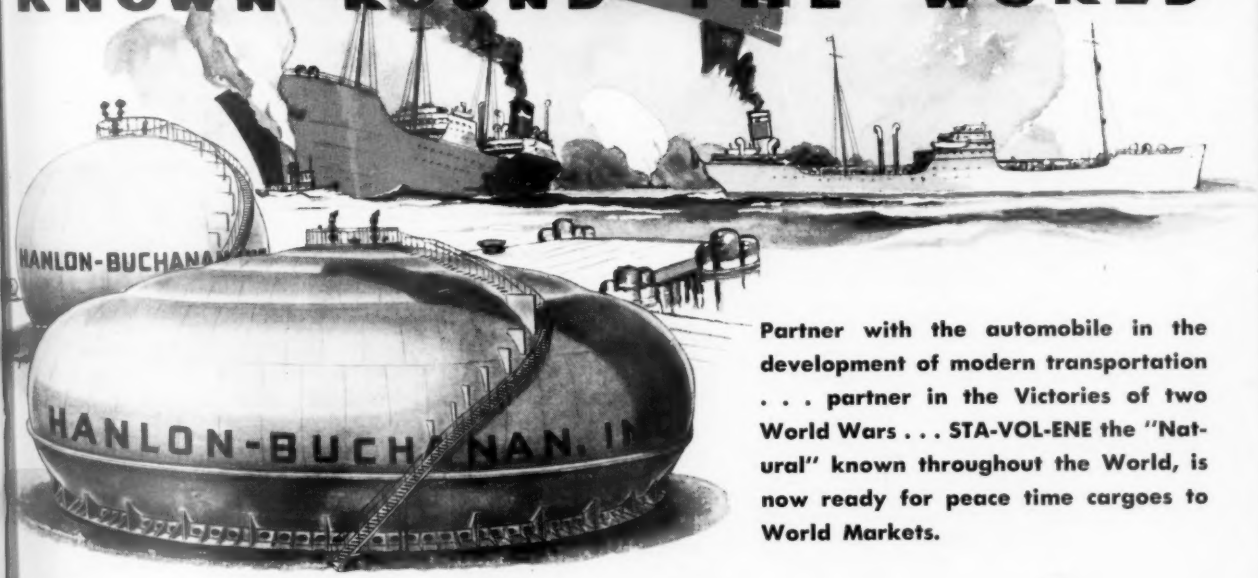

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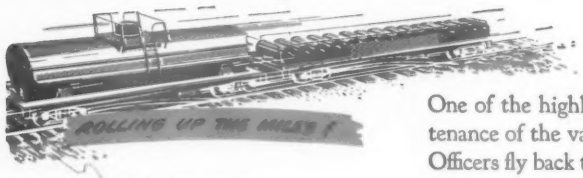
Official U.S. Navy Photograph

Columbia keeps its fleets of Chlorine and Caustic Cars



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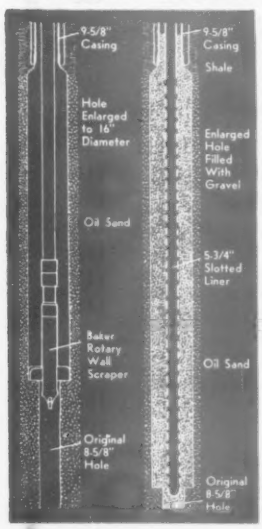
REMARKABLE REAMING CAPACITY

One of the outstanding features of the Baker Rotary Wall Scraper is its remarkable reaming capacity in relation to the O.D. of the tool. It has a maximum expansion on the Cutter Blades ranging from 4" to 36".

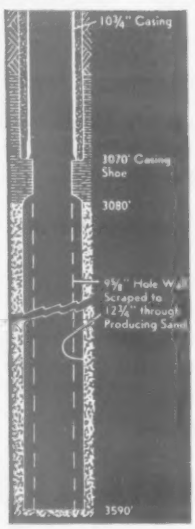
SAFETY

The safety of this tool has been ably demonstrated in thousands of successful runs made in oil fields throughout the world under most adverse operating conditions.

TYPICAL WALL SCRAPER APPLICATIONS



Enlarging hole for gravel packing around liner.



Scraping face of oil sand and enlarging bore for maximum recovery.

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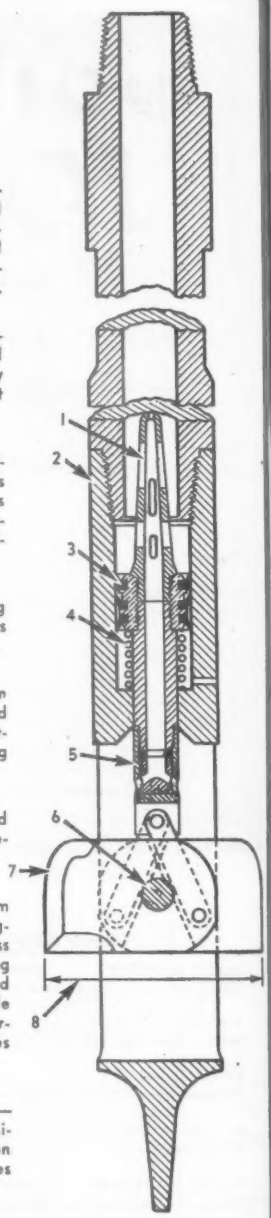

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the OIL AND GAS JOURNAL

Trends

Crude-Oil Production
By States—Page 160

CRUDE-OIL STOCKS 214,480,000 bbl. as of September 15—up 759,000 bbl. One year ago 221,989,000 bbl.

GASOLINE STOCKS 85,209,000 bbl. as of September 15—down 21,000 bbl. One year ago 77,369,000 bbl.

RESIDUAL FUEL-OIL STOCKS 48,470,000 bbl. as of September 15—up 599,000 bbl. One year ago 62,243,000 bbl.

GAS OIL AND DISTILLATE STOCKS 43,507,000 bbl. as of September 15—up 1,318,000 bbl. One year ago 42,082,000 bbl.

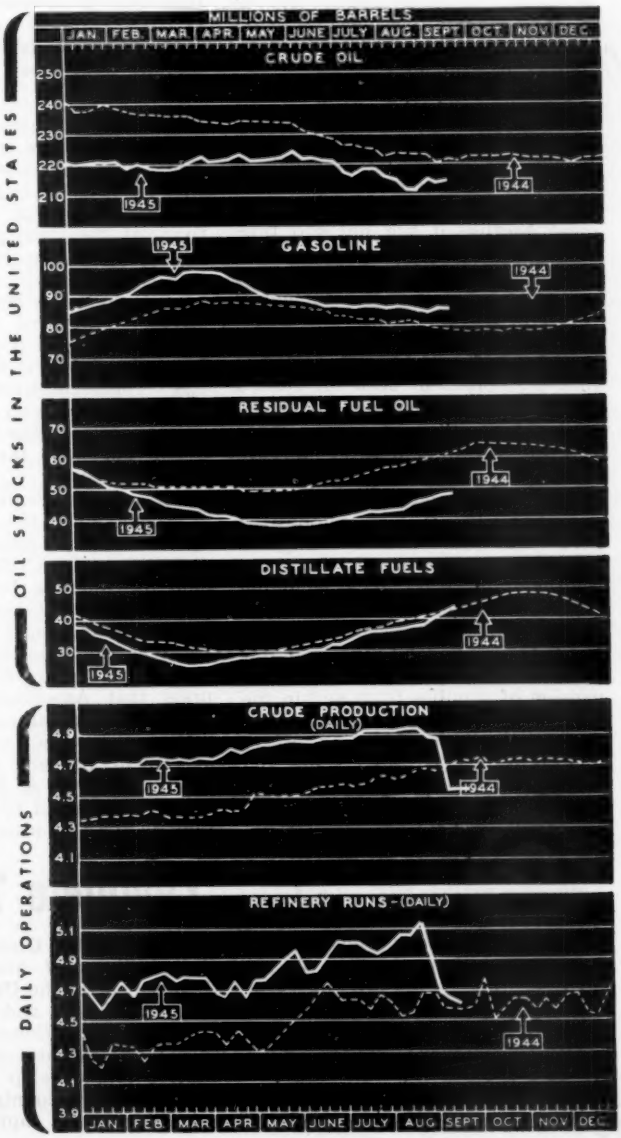
CRUDE-OIL PRODUCTION 4,537,350 bbl. as of September 22—up 750 bbl. One year ago 4,737,510 bbl.

REFINERY RUNS 4,616,000 bbl. daily week ended September 15—down 24,000 bbl. One year ago 4,634,000 bbl.

IMPROVEMENT in the industry's rate of well completions since the VJ-Day slump was climaxed last week by a sharp rise in the curve, equalling the year's previous record. Completion of 596 wells last week focused attention on increased drilling activity indicated for the last 3 weeks in September. The plunge of the completion curve from 596 finalled wells during the week ended July 28 to 475 at the start of September was interpreted in some quarters as signalling a sharp reduction in drilling. Restoration of the completion rate to levels prevailing immediately before Japan surrendered, indicates that the industry will not fall much short of the 27,000-well program for the year.

THE flow of new rigs into contractor and company operations is becoming an increasingly important factor in completions. Many of the new rigs are equipped with new parts or accessories designed to improve efficiency and reduce costs. One of the new developments is an entirely new mud pump which features increased capacity. Drilling engineers have recognized pump capacity as one of the limiting factors on prewar rigs and cooperated with manufacturers in working out designs especially suited to deep work. New control instruments and equipment for synchronizing the power output of multiple engines are among other developments contributing to more efficient drilling units.

THE drilling end of the business has numerous unsolved problems but the progress made in a few short weeks since war emergency controls were relaxed is indicative of the vigor in this branch. Fixed costs in drilling rose steeply during the war. Inexperienced manpower cost contractors and companies operating their own drilling tools an infinite sum. Obsolete equipment was used as an expedient on hundreds of wells but it too was costly in operation and contributed proportionately to greater drilling expense. Experience with the most modern drilling equipment available is inconclusive for many of the components of the newest rigs are undergoing first field service. The drilling branch gives assurance, however, that the most efficient equipment will be adopted just as rapidly as it becomes available. This means that operating companies can intensify the search for reserves at lower cost.



XUM

Journal Editor Reports on Revised Oil Pact Signed In London

by C. O. Willson

The Journal's editor, attending the sessions between English and American representatives in London, who reached an agreement on petroleum matters this week, cabled this story to the Journal. This conference marks the end of Willson's foreign itinerary. His articles on Middle East oil developments are now cleared, and will be published regularly, beginning next week.

LONDON.—(By cable). After a week of discussion, the revised Anglo-American petroleum agreement was signed here September 24 by Secretary of Interior Harold L. Ickes representing the Government of the United States and Fuel Minister Emanuel Shinwell representing the United Kingdom of Great Britain and Ireland. The two cabinet officers headed American and British delegations which agreed upon terms of the agreement. The agreement will now be submitted to the United States Senate and if approved by that body can be made effective immediately. The British action in signing the agreement was authorized by the cabinet and requires no further approval. It can and probably will be brought up for discussion and explanation in the forthcoming session of the British Parliament.

The approval this week of the agreement came as a surprise to local oil men and the London press. Before the conference opened, it was feared that the new Labor cabinet would not care to sign an agreement because it had not had time to consider provisions and because of the urgency of other matters with which the new government is confronted. Since the conference opened it has also been predicted that British representatives would seek postponement until the results of the Anglo-American trade and financial conferences now under way in Washington were known. Should the Washington conference fail to agree upon the matters under discussion it was emphasized here that the United Kingdom would be compelled to work out solutions for its problems including oil without cooperation of the United States. In regard to oil it has been pointed out over past few days, that this would mean the expansion of supplies from within the Sterling block countries of the Middle East and the shutting off of imports from the United States and other dollar countries. The quick approval of the petroleum agreement is now interpreted as reflecting desire on part of the new British Government to demonstrate its willingness to cooperate with American industry and thus give support to those who are conducting the negotiations at Washington in regard to the dollar-sterling controversy. Shinwell, in answer to questions from his own press, indicated that he had been assured a satisfactory settlement of this problem through the American representatives.

No major changes were made in agreement during conferences here. While the agreement differs materially from the original document which was signed by representatives of the two governments in August 1944, the approval pact is substantially the same as that agreed upon in Washington after original agreement was withdrawn from consideration by the United States in January this year.

Six representatives of the petroleum industry who have acted as advisers here to the American delegation approved the agreement as signed.

At a press conference Monday afternoon when the signing of the agreement was announced by Ickes and Shinwell, A. Jacobsen, president of Amerada Petroleum Corp., and chairman of the National Oil Policy Committee, Petroleum Industry War Council, explained in answer to an inquiry from the British press that American oil men objected to original pact because of ambiguity in its terms. The new agreement, he said, is explicit and specific. George A. Hill, Jr., president, Houston Oil Co., who led the fight in the oil industry against the original agreement, said "a great achievement has been accomplished in the new agreement."

The primary objective of new agreement is to assure orderly production and distribution of the world's petroleum through the cooperation of the two countries whose nationals control approximately 90 per cent of the world's petroleum outside Russia. The agreement is voluntary as to enforcement and does not interfere in any way with domestic operations within the two countries. It provides for multilateral agreements with other producing and consuming countries at later dates, including the formation of an International Petroleum Council.

The present agreement is to be implemented through a six-man commission with equal representation from each country. Ralph K. Davies, deputy petroleum administrator, and Charles B. Rayner, petroleum adviser to the State Department, with Ickes negotiated the new agreement representing the United States. Shinwell and Hector McNeil, parliamentary undersecretary of state for foreign affairs, represented the British Government.

Official advisers to the United Kingdom delegation were Sir Norman Duke and F. C. Starling of the ministry of fuel and power; Sir David Waley, treasury; R. A. Gallop, foreign office; Victor Butler, British petroleum representative in Washington, and K. L. Stock, ministry of fuel and power who acted as secretary.

United States advisers were: William R. Boyd, Jr., president of American Petroleum Institute and chairman of the Petroleum Industry War Council; Jacobsen, Hill, Alton Jones, president, Cities Service Co.; Joseph E. Pogue, vice president, Chase National Bank, and Ralph T. Zook, president, Independent Petroleum Association of America.

Several members of the American delegation departed for Paris September 27. Most of the PAW and State Department representation will return to Washington next week.

Complete Text of Revised Agreement

Preamble: The Government of the United States of America and the Government of the United Kingdom of Great Britain and Northern Ireland, whose nationals hold, to a substantial extent jointly, rights to explore and develop petroleum resources in other countries, recognize:

1. That ample supplies of petroleum, available in international trade to meet increasing market demands, are essential for both the security and economic well being of nations.

2. That for the foreseeable future the petroleum resources of the world are adequate to assure the availability of such supplies.

3. That the prosperity and secu-

rity of all nations require the efficient and orderly development of the international petroleum trade.

4. That the orderly development of the international petroleum trade can best be promoted by international agreement among all countries interested in the petroleum trade, whether as producers or consumers.

The two Governments have therefore decided, as a preliminary measure to the calling of an international conference to consider the negotiation of a multilateral petroleum agreement, to conclude the following agreement.

Article 1: The signatory Governments agree that the international petroleum trade in all its aspects should be conducted in an orderly manner on a world-wide basis with due regard to the considerations set forth in the preamble, and within the frame work of applicable laws and concession contracts, to this end and subject always to considerations of military security and to the provisions of such arrangements for the preservation of peace and prevention of aggression as may be in force, the signatory Governments affirm the following general principles with respect to the international petroleum trade:

a. That adequate supplies of petroleum, which shall in this agreement mean crude petroleum and its derivatives, should be accessible in international trade to the nationals of all countries on a competitive and nondiscriminatory basis.

b. That, in making supplies of petroleum thus accessible in international trade, the interests of producing countries should be safeguarded with a view to their economic advancement.

Article 2: In furtherance of the purposes of this agreement, the signatory Governments will so direct their efforts:

a. That all valid concession contracts and lawfully acquired rights shall be respected and that there shall be no interference directly or indirectly with such contracts or rights.

b. That with regard to the acquisition of exploration and development rights the principle of equal opportunity shall be respected.

c. That the exploration for and development of petroleum resources, the construction and operation of refineries and other facilities, and the distribution of petroleum shall not be hampered by restrictions inconsistent with the purposes of this agreement.

Article 3: (1) With a view to the wider adoption of the principles embodied in this agreement, the signatory Governments agree that as soon as practicable they will propose to the Governments of all interested producing and consuming countries the negotiation of an international petroleum agreement which would establish a permanent international petroleum council. (2) To this end the signatory Governments agree to formulate at an early date plans for an international conference to negotiate such a multilateral petroleum agreement. They will consult together and with other interested Governments with a view to taking whatever action is necessary to prepare for the proposed conference.

Article 4: (1) Numerous problems of joint immediate interest to the signatory Governments with respect to the international petroleum trade should be discussed and resolved on a cooperative interim basis if the general petroleum supply situation is not to deteriorate.

2. With this end in view, the signatory Governments agree to establish an international petroleum commission to be composed of six members, three members to be appointed immediately by each Government. To enable the commission to maintain close contact with the operations of the petroleum industry, the signatory Governments will facilitate full and adequate consultation with their nationals engaged in the petroleum industry.

3. In furtherance of and in accordance with the purposes of this agreement, the commission shall consider problems of mutual interest to the signatory Governments and their nationals, and with a view to the equitable disposition of such problems it shall be charged with the following duties and responsibilities:

a. To study the problems of the international petroleum trade caused by dislocations resulting from war.

b. To study past and current trends in the international petroleum trade.

c. To study the effects of changing technology upon the industrial petroleum trade.

d. To prepare periodic estimates of world demands for petroleum and of the supplies available for meeting the demands, and to report as to means by which such demands and supplies may be correlated so as to further the efficient and orderly conduct of the international petroleum trade.

e. To make such additional reports as may be appropriate for achieving the purposes of this agreement and for the broader general understanding of the problems of the international petroleum trade.

4. The commission shall have power to regulate its procedure and shall establish such organization as may be necessary to carry out its functions under the agreement. The expenses of the commission shall be shared equally by the signatory Governments.

Article 5: The signatory Governments agree:

a. That they will seek to obtain the collaboration of the Governments of other producing and consuming countries for the realization of the purposes of this agreement, and to consult with such Governments in connection with activities of the commission.

b. That they will assist in making available to the commission such information as may be required for the discharge of its functions.

Article 6: The signatory Governments agree:

a. That the reports of the commission shall be published unless in any particular case either Government decides otherwise.

b. That no provision in this agreement shall be construed to require either Government to act upon any report or proposal made by the commission, or to require the nationals of either Government to comply with any report or proposal made by the commission, whether or not the report or proposal is approved by that Government.

Article 7: The signatory Governments agree:

a. That the general purpose of this agreement is to facilitate the orderly development of the international petroleum trade, and that no provision in this agreement, with the exception of Article 2, is to be construed as applying to the operation of the domestic petroleum industry within the country of either Government.

b. That nothing in this agreement shall be construed as impairing or modifying any law or regulation, or the right to enact any law or regulation, relating to the importation of petroleum into the country of either Government.

c. That, for the purposes of this article, the word "country" shall mean:

1. In relation to the Government of the United Kingdom of Great Britain and Northern Ireland, the United Kingdom, all British colonies, overseas territories, protectorates, protected states, and all mandated territories administered by that Government.

2. In relation to the Government of the United States of America, the continental United States and all territory under the jurisdiction of the United States, lists of which, as of the date of this agreement, have been exchanged.

Article 8: This agreement shall enter into force upon a date to be agreed upon after each Government shall have notified the other of its readiness to bring the agreement into force and shall continue in force until 3 months after notice of termination has been given by either Government or until it is superseded by the international petroleum agreement contemplated in Article 3.

Government's Labor Conciliation Agency Moves in Oil Strikes

WASHINGTON.—The federal Government's labor conciliation machinery is attempting this week to end the fast-spreading strike of refinery workers which threatens to cause severe gasoline and fuel-oil shortages in many industrial centers throughout the country.

Edgar L. Warren, newly appointed chief of the Conciliation Division of the Department of Labor, called a conference of company and union officials to meet Tuesday in Chicago with a special commission composed of Justice William L. Knaus of the Colorado Supreme Court, August J. Hummert of St. Louis, and James O. Hubbard of the Texas district of the Conciliation Service.

Striking workers are generally members of the Oil Workers International Union (C.I.O.), which is demanding a 30 per cent increase in pay in order to give workers the same "take home" pay for a 40-hour week as they received for a 48-hour work week during the war. Many of the companies have already voluntarily offered a 15 per cent increase over wartime increases in hourly rates, but this has not been accepted by the C.I.O. union.

In spite of threatened gasoline shortages the Government has no plans for reinstituting gasoline rationing, though some cities may improvise their own plans. The rationing system of Office of Price Administration has been dismantled, and Directive 59 of Petroleum Administration for War, which allocated supplies among distributors on the eastern seaboard is scheduled for exporation on September 30.

Commenting on the strike situation, Sen. Ed Moore of Oklahoma wrote Director John W. Snyder of the Office of War Mobilization and Reconversion that ceilings should be removed from oil prices in order to permit companies freedom in collective bargaining with employes.

Regardless of the merits of the workers' demands, Moore said, the companies are in an impossible position when their prices are fixed by the Government while labor is free to enforce its demands for higher wages and salaries.

Eugene Holman, president of Standard Oil Co. (N.J.), wired Conciliation Director Warren that his company and affiliates were not planning to be present at the Chicago meeting to which Warren had invited representatives of Standard and other oil companies. Of the 80,000 workers employed by these companies, Holman said, only a few hundred are represented by the C.I.O. union, and the rest are represented by other bargaining agencies. He said that the company has already offered a 15 per cent pay increase which has been accepted by the workers of most plants and in the others discussions with employes are proceeding in an orderly manner.

For this reason, Holman said, no good purpose would be served by having a representative of Standard at the conference with the C.I.O. union and the management of companies in which this union is represented.

Strikes Halt Refineries With Total Capacity of 1,000,000 Bbl. Daily

OIL-INDUSTRY strikes at midweek halted operation of Middle West and Gulf Coast refineries with combined crude-oil capacity of nearly 1,000,000 bbl. daily. Immobilization of refineries forced curtailment of pipe-line operations and producers in parts of the Illinois Basin and Mid-Continent districts were limited to 30 to 40 per cent of capacity output. Workers had voted to strike at additional refineries having crude-oil capacity of more than 200,000 bbl. per day.

Shortages of motor fuel were developing at Toledo and Detroit and dealers limited sales per customer at several other points which are normally supplied with gasoline from one of the struck refineries.

Harry T. Klein, president of The Texas Co., and W. T. Holliday, president of Standard Oil Co. of Ohio, issued statements charging the Oil Workers International Union (C.I.O.) with violation of contracts with the companies. Klein said that since January 1941 basic wages and salaries have been increased approximately 23 per cent and that the company had offered another 15 per cent advance when operations are fully converted to a 40-hour week.

Union employes at all shutdown refineries were demanding an increase of 30 per cent in basic hourly rates of pay, insisting on 52 hours of pay for 40 hours of work. During the war, most refinery employes worked 48 hours, receiving time and one-half for 8 hours.

Refineries already shutdown by strikes, with the rated daily crude-oil capacity, follow:

Texas

Gulf Oil Corp., Port Arthur, 154,000; The Texas Co., Port Arthur, 135,000; Pure Oil Co., Port Arthur, 55,000; Sinclair Refining Co., Houston, 73,000; Southport Petroleum Co., Texas City, 18,500; Republic Oil Refining Co., Texas City, 20,000; Shell Oil Co., Inc., Houston, 74,000; Magnolia Petroleum Co., Beaumont, 110,000; Pan American Refining Corp., Texas City, 100,000.

Indiana

Socony-Vacuum Oil Co., Inc., East Chicago, 25,000; Cities Service Oil Co., East Chicago, 30,000; Sinclair Refining Co., East Chicago, 55,000.

Michigan

Socony-Vacuum Oil Co., Inc., Detroit (Trenton), 25,000.

Illinois

The Texas Co., Lawrenceville, 33,000; The Texas Co., Lockport, 50,000.

Ohio

Pure Oil Co., Toledo, 30,000; Standard Oil Co. of Ohio, Toledo, 20,000; Gulf Refining Co., Toledo, 21,000; Sun Oil Co., Toledo, 35,000; Standard Oil Co. of Ohio, Lima, 10,500; Sohio, Cleveland, 37,500.

West Virginia

Pure Oil Co., Cabin Creek, 6,000.

In addition, CIO employes of the following refineries have voted to strike: Crown Central Petroleum Co., Houston, 18,000; The Texas Co., Galena Park (Houston), 27,500; Atlantic Refining Co., Port Arthur, 23,000; Sinclair Refining Co., Corpus Christi, 27,000; Taylor Refining Co., Corpus Christi, 22,000.

October Production Quota Cut 108,500 Bbl.

WASHINGTON. — The Petroleum Administration for War this week announced that its estimates of petroleum demand for October indicate that a daily rate of 4,803,570 bbl. of all petroleum liquids should be the domestic production for the month. Of this quantity, it is estimated that 4,464,400 bbl. daily should be crude oil.

The crude-oil production rate for October represents a reduction of 108,500 bbl. from daily quantity of crude oil which the calculations showed would be required to meet September demand. The anticipated natural-gasoline rate remains unchanged.

PAW has reiterated its position to the effect that these estimates of production rates for October will be the last to be furnished by this agency. It is anticipated that the normal peacetime channels for preparing and issuing demand forecasts will be resumed by the end of October.

THIS WEEK

STRIKES—Gasoline back on scarcity list in some areas as CIO strikes gain headway. . . . Jittery motorists drain service-station tanks. . . . Emergency rationing ordered in Toledo. . . . ¶Many refineries down. . . . Others ready to close as workers take strike votes. . . . Estimated one-third of country's gasoline production at standstill. . . . ¶Plans under way to give essential users first call on dwindling supplies. . . . ¶Eastern motorists likely to be hard hit. . . . Spreading strikes in Gulf Coast refineries threaten Southwest with gasoline famine. . . . ¶Some independents say they must quit business if wage increases demanded are granted unless crude ceilings are raised too.

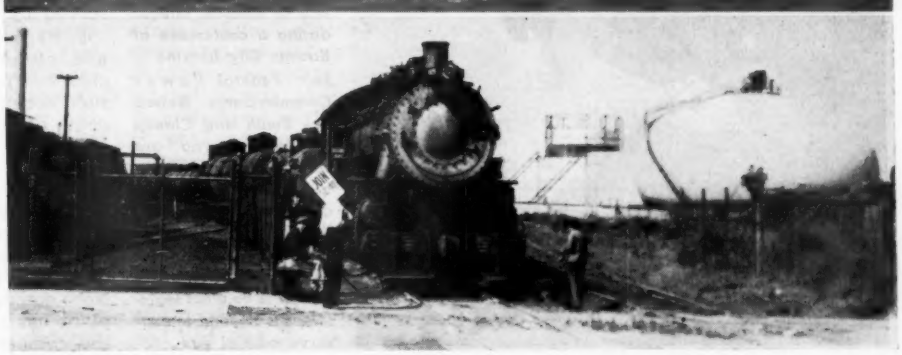
PRODUCTION—Nation's daily crude output 4,537,350 bbl., up 750. . . . Compares with PAW's production quota of 4,464,400 bbl. for October, down 108,500. . . . Increased output in eastern area and Illinois almost canceled by drop of 6,000 bbl. in Michigan. . . . West Edmond still rising. . . . Now at daily rate of 87,900 bbl. from 651 wells. . . . ¶Week's completions 596, up 60. . . . ¶Sharp increase in drilling swamp lands and along coast of North Carolina forecast. . . . Thousands of acres leased by state to majors and independents. . . . New Jersey Standard has drilling equipment in Albemarle Sound area.

MARVELS—Technologists tell FPC natural gas will contribute ingredients for raincoats, juke-boxes, fertilizers, protective coatings "you'll remove as you'd peel a banana," flashlights, football headgear, fenders, inner tubes, Army bugles equal to "best that ever tooted reveille," phonograph records that won't break and electrical insulation that won't burn, armor for aircraft crews. . . . ¶Carter laboratories helped develop radio proximity fuse. . . . Described as war's second most important invention. . . . Detonates shell when near target. . . . Carter men devised mechanism to prevent premature explosion. . . . ¶Egloff says catalytic cracking will dominate postwar refining. . . . Charging capacity of "cat" plant now exceeds 1,000,000 bbl. gas oil daily. . . . Will create new industries, expand old ones. . . .

INTERNATIONAL—Revised Anglo-American oil agreement signed. . . . Effective upon ratification by U. S. Senate. . . . "Major step in putting international oil trade on orderly basis," says Ickes. . . . Notable spirit of friendliness pervaded London conference. . . . ¶New factor in dispute over exporting gas into Mexico. . . . Applicant says his production is from horizon that extends across border. . . . Gas wells on either side can drain from the other. . . .

CLASH—Political battle rising over disposition of war emergency pipe lines. . . . Representative Voorhis protests against RFC proposal to fill lines with water and preservative. . . . Says plan would cost $14,000,000. . . . Senator O'Daniel predicts big interests will end up by buying lines at 10 cents on the dollar. . . . "Should be ripped up." . . . ¶Secret testimony submitted in Phillips suit charging Shell with patent infringement. . . . Involves aviation-gasoline process. . . . Secrecy imposed under Espionage Act. . . .

ECONOMICS—Socony-Vacuum study reveals no sign of monopoly in oil industry. . . . Competition has resulted in lower prices, higher-quality products, better service, dissemination of business among innumerable companies. . . . ¶Oil jobbers denounce federal tax discrimination in favor of cooperative organizations. . . .



International News Photos

These strike scenes at Middle West refinery gates were symbolic of similar action this week by CIO union members at approximately 15 plants scattered in seven states. Refineries shutdown at midweek by strikes have combined daily crude-oil capacity of nearly 1,000,000 bbl. Many of the idle plants are the most modern and their normal yield of gasoline is around 400,000 bbl. per day

FPC Regulations Would Nullify Effect of State Conservation Laws

KANSAS CITY. — If the Federal Power Commission continues to claim authority to consider the cost of gas-producing properties and then uses this cost in fixing the price of gas at the well head as a base in computing reasonable rates to be allowed interstate gas pipe lines, it will nullify the conservation powers of the state regulatory bodies and promote waste.

This was the key principle brought out in testimony by opponents of the FPC's claims to jurisdiction in the hearings at Kansas City which opened last week and were resumed September 24. Among other high points in the testimony presented, were the following:

1. The present proven reserves of natural gas represent between 35 and 50 years' supply with every reasonable prospect that as a by-product of deeper exploration for oil the reserves will increase even more rapidly in the future than in the past. This evidence was given by Dr. E. DeGolyer, internationally known geologist.

2. The production of gas in many places is so inextricably mingled with the production of oil that extension of federal control over gas to the well-head would inevitably involve federal control of oil production. While not directly stated, this was the clear implication of testimony by B. A. Hardey, Louisiana independent operator, in presenting the resolutions of the Independent Petroleum Association of America.

3. Gas should not be exported and used for industrial fuel in states having adequate coal or other fuel resources, according to Mayor John B. Gage of Kansas City. He expressed the view that the FPC should regulate the end use of natural gas to prevent this.

The contrary view was expressed that control of end use and refusal to export gas into areas of competition with other fuels would only handicap conservation in the producing states. Low prices resulting from a lack of market outlets is still one of the stumbling blocks to complete conservation. This was brought out partly in cross-examination by Wesley E. Disney, former congressman and now representing the natural gas industry committee, and partly by Hardey in presenting the I.P.A.A. resolutions. Disney also challenged the constitutionality of such a procedure as setting up state barriers to trade, and pointed out that if the same principle were applied to oil, there would be no nation-wide distribution of gasoline.

4. The railroads, as large transporters of coal, the coal operators, and various labor unions, whose employment depends on coal, are very much interested in the hearings, and were represented by legal counsel, who cross-examined some of the witnesses. The principal interest of these organizations at Kansas City appeared to be in gathering information on costs, prices, and volume of gas. Their obvious concern was with the probable future effect of gas competition for markets now served by coal.

Above: Mayor John B. Gage, of Kansas City, Earl Foster, executive secretary, Interstate Oil Compact Commission, of Oklahoma City, and Gov. Andrew Schoeppel, of Kansas, caught during a conference at Kansas City hearing

Left: Federal Power Commissioners Nelson Lee Smith and Claude L. Draper, who are seeking facts showing how much gas is produced, its sources and probable potential supply, to be used in the commission's report to Congress on what legislation is needed to conserve natural gas

5. Regardless of how intriguing and interesting the various synthetic chemical products from gas are, this field consumes not more than 1 per cent of the gas now marketed. Moreover, in most of them, after extracting the chemicals, the processing leaves the bulk of the gas unimpaired for use as fuel and light.

The possible major exception to this is the Fischer-Tropsch process of making gasoline from natural gas. No commercial Fischer - Tropsch plant has yet been constructed, and the competitive economics of gaso-

line from crude oil versus gasoline from gas via this process remain to be determined.

Most of the synthetic products mentioned could also be made from oil or coal, although in some cases they are more easily procurable from gas. For most such products it would be cheaper to locate the plant near the gas source and ship the finished product. Exportation of gas would not effect the chances of establishment of such a plant, if the total supply available was sufficient to assure the chemical plant sufficient gas reserves for a long operating life.

These factors regarding synthetic chemicals were brought out in testimany by Dr. C. M. Marberg and Dr. E. P. Pratt of Midwest Research Institute, Kansas City; by Benjamin Miller, private consultant of New York, retained by the state of Kansas, and by J. C. Hawthorne of the Kansas City Testing Laboratory. Some of this was direct testimony, part of it was brought out on cross-examination by Disney and by George Slaff, chief counsel for the FPC investigating staff.

Schoeppel Questions FPC Authority

The sharp challenges to the commission's authority were started by Andrew Schoeppel of Kansas. Speaking as chairman of the Interstate Oil Compact Commission, he stated:

"Practically every American citizen recognizes that whatever can be most efficiently done by the state or local government should not be attempted by the federal Government. We think this general principle is accepted by all men, regardless of political affiliation. If the conservation of gas and oil can best be carried out by the states, all will agree that the states should retain such power."

The resolutions adopted by I.P.A.A. were equally sharp and more specific in their challenges to the authority claimed by the FPC. The main points of these resolutions were:

1. The states have the vested and constitutional right of regulation and jurisdiction over the production and conservation of natural gas in every phase up to the delivery point where interstate commerce commences. No jurisdiction back of that point should be conferred upon the FPC or any other federal agency, nor should any such agency seek to exercise any power not specifically conferred on it by law under the Constitution.

2. Jurisdiction over the end use of gas should not be conferred upon a federal bureau. Competition between fuels should be left to the free determination of competitive economics.

3. Authority for public interest regulation of production, storage, gathering, and handling of natural gas now rests with the states, and no federal laws are justified, demanded, or needed.

4. If the FPC should persist in its attempts to control, either directly or indirectly, the production, processing, gathering and compressing, or the price of gas prior to its sale for resale from the interstate lines, or in incorporating producing and gathering properties in the rate base for determining rates for transmission in interstate commerce, then either the functions of the FPC in respect to interstate transmission of gas should be transferred to the Interstate Commerce Commission, or the jurisdiction of the FPC should be, by additional legislation, clearly limited to the interstate transportation of gas and the sale of gas in interstate commerce for resale.

5. The policy of the FPC in attempting to give gas producing and gathering properties a utility status, and the valuation of gas producing properties and natural gas on a cost formula, is without and beyond the jurisdiction of the FPC. The utility principle of regulation cannot be adapted to the gas producing and gathering business. The devaluation of such properties in low cost producing areas directly tends to encourage waste, destroys the inducement to save gas, and is a positive deterrent and obstacle to gas conservation and good producing practices.

7. Efforts of the FPC to extend its jurisdiction to the gas producing and gathering properties of a producer who is not a natural gas company are beyond the legal power vested in the commission. Removal of such unauthorized efforts and threats, either by FPC's abandoning of its claims, or by legislative mandate, will substantially aid in the conservation and marketing of gas.

Danger of Retaliation

M. M. Kinsey, president, St. Louis Board of Public Service, expressed concern at the growing tendency to suggest restrictions or prohibition of the export of gas from the producing states. Such actions, he stated, seemed provincial and would engender retaliatory measures by consuming states, affecting exports of their own natural resources. As an example, he cited that if Texas prohibited export of gas to Missouri, then Missouri might prohibit export of lead and zinc to Texas.

Considerable testimony was introduced regarding local aspects of the St. Louis gas situation. The local distributing company sells a mixture of artificial and natural gas. Its interstate supplier testified that it was able and willing to furnish additional supplies of natural gas, and had sold the local company all the natural gas it would buy. Testimony was introduced claiming that if a connecting line could be laid 65 miles north to another trunk gas line, the safety factor of alternate natural-gas supply sources would permit abandonment of the artificial-gas standby facilities.

During the hearings, considerable time was devoted to presentation of data on production, price, and utilization of gas from fields in Kansas. These data were presented by the Kansas State Corporation Commission. Theo. A. Morgan, conservation director, told the commission that the price of gas at the well in Kansas varies from 3 cents to 10 cents per 1,000 cu. ft.; that Kansas gas is marketed in the states of Colorado, Missouri, Nebraska, Idaho, Minnesota, South Dakota, Illinois, Indiana, Ohio, Michigan, and Oklahoma. About 80 per cent of the Hugoton gas field production is exported to other states. On cross-examination by Charles I. Francis, chairman of the Texas legal committee, Morgan stated that there had been no waste of gas in Kansas since the passage of its conservation laws.

Following the Kansas City hearing, other regional meetings will be held in Oklahoma City, New Orleans, and Dallas.

I.N.G.A. to Hold Annual Meeting November 26

OKLAHOMA CITY. — The board of directors of Independent Natural Gas Association of America has voted to hold the annual membership meeting of the association in Dallas November 26, the day before Federal Power Commission opens its natural-gas investigation hearing there.

The convention arrangements committee is composed of Wm. H. Wildes, C. H. Zachry, John A. Ferguson, Charles L. Orr; program committee, D. A. Hulcy, Clyde H. Alexander, N. R. Royall, Jr., John A. Ferguson; committee to nominate directors to fill vacancies on the board, Burt R. Bay, Joseph Bowes, Wm. H. Wildes, J. H. Dunn, B. A. Hardey, Frank Buttram.

1946 A.A.P.G. Meeting Set For April in Chicago

The first postwar annual convention of the American Association of Petroleum Geologists will be held at the Stevens Hotel in Chicago, April 2, 3, and 4, 1946. This was announced September 22 by the executive committee of the association. The business committee will hold its usual preconvention meeting April 1.

INTERNATIONAL

Venezuelan Tectonic Map Being Prepared

Dr. Walter H. Bucher, professor of structural geology, Columbia University, New York, has been granted a leave of absence to collaborate with the Servicio Tecnico de Geologia of the Ministerio de Fomento of the Venezuelan Government in the preparation of a tectonic map of Venezuela. Dr. Bucher is now in Caracas serving in an editorial capacity in the compilation and correlation of data obtained from the oil companies, mining companies and government surveys and in the coordination of this detailed information into a unified picture of the basic structural features of Venezuela.

The proposed tectonic map will be of vital significance and importance to the scientific knowledge of the structural geology of Venezuela. The map will be published on a scale of 1:1,000,000 and will be similar to the tectonic map of North America sponsored by the committee on tectonics of the National Research Council and recently published by the American Association of Petroleum Geologists. The tectonic map of Venezuela, together with a geologic map on the scale of 1:1,000,000 will be included in a comprehensive book on the Geology of Venezuela which the Servicio Tecnico de Geologia is preparing with the aid of 18 geologists particularly familiar with the geology of this country and which will be published in both the United States and Venezuela.

DR. WALTER H. BUCHER

Dr. Bucher was born in Ohio in 1888. Upon termination of his studies in the secondary schools, he entered the University of Heidelberg where he received the degree of doctor of philosophy in 1911. Upon his return to the United States he began to teach in the University of Cincinnati. In 1927 he was named research professor of structural geology. In 1940 he entered the University of Columbia as professor of structural geology.

He has written numerous scientific articles and a book entitled "The Deformation of the Earth's Crust" (1933). As a member of the committee on structural geology of the National Research Council he had a prominent part in the organization and preparation of the North American tectonic map.

Two Important Tests Starting in Colombia

Two important wildcat tests in Colombia are starting drilling operations this month, adding to the growing list of exploratory wells in that country which are attracting world-wide attention.

Richmond Petroleum Co. is starting a projected deep test, possibly to 10,000 ft., on the Caraballo concession. The operating interest was obtained from Compania Colombiana de Petroleo El Neta which has title to the concession of 43,500 hectares (108,500 acres). The wildcat test is in the approximate center of the concession and is about 40 miles northwest of the Dificil producing field. The test well is about 55 miles from Caribbean tidewater.

Petroleos Ariguani S. A., a new company owned 50 per cent by Tropical Oil Co. and 50 per cent by Colombian nationals, is starting another 10,000-ft. wildcat test southwest of Shell's Dificil production. In an adjacent block, Tropical is starting road construction to another wildcat drill site. The company is laying 50 miles of 4-in. line from Andian National Pipe Line Co.'s trunk pipe-line system. Fuel oil for the wildcat drilling operation will be delivered through the 4-in. artery.

In the Colombian llanos region, Shell 2 San Martin, 700 miles from Caribbean tidewater, is reported cleaning out at 5,900 ft. At this depth the well is said to be in Tertiary.

Colombian Petroleum Co.'s Cretaceous test, 4 Tres Bocas, on the Barco concession, is drilling around 7,700 ft. Operators expect to reach Cretaceous limestone at about 9,000 to 10,000 ft.

What Others Say

Proposes Price Action

Dear Sirs:

The oil subsidy payment as a war measure will be terminated shortly and the oil producer will be at the crossroads again.

The future for the oil producer is dependent entirely on price. The decision on the needed price increase for crude oil must be made by the Office of Price Administration, until price controls are rescinded, or by Congress. It is necessary, consequently, for oil producers to present immediately the facts to OPA in Washington and furnish a copy to their respective Congressmen in Washington for support of a general crude oil price increase before subsidy oil payments are abolished.

Favorable action should result if each oil producer individually presents his own facts to substantiate a crude oil price increase. The independent oil producer must not depend entirely upon his trade associations to make this vital fight. Letters to the OPA might include the oil producers' experience on some of the following topics and all other important data which will support the request for a crude oil price increase.

Factual data from the oil producers' files on the following would definitely be valuable for the OPA in arriving at the amount of the price increase.

1. Tabulations showing the per cent increase in drilling costs during the last 5 years for comparable work.

2. Tabulations showing the per cent increase in operating costs during the last 5 years.

3. Tabulations showing the per cent increase in the cost of finding or replacing crude oil during the last 5 years.

4. Discussion concerning efficient producing rates for oil fields. Be specific and indicate the per cent of your present production which exceeds your estimate of the most efficient rate.

5. Discussion concerning employment of returning veterans and defense plant workers by your company if the price of crude is increased. An increase would assure large employment and a high rate of activity in the petroleum industry.

6. Discuss the results of "do-nothing" price policies of the Government with the attendant unemployment. Full employment by the oil producer will require a price increase.

7. Discussion of ample oil supply to meet all the national defense needs.

8. Discussion of peculiar conditions connected with the production of petroleum in that an oil producer may be able to drain the oil from adjacent lands. Producers cannot shut down and stop selling oil when the price of crude is below their operating cost because the loss of oil by drainage to neighboring leases would be a greater loss.

C. H. KEPLINGER,
Keplinger and Wanenmacher, petroleum engineers, Tulsa.

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BY PATRICK C. BOYLE

the OIL AND GAS JOURNAL

Wage Earners Lose

MANY significant aspects of the oil industry's labor situation are being unveiled by strikes which this week paralyzed a quarter of the nation's refining capacity. Work stoppages in the manufacturing branch are causing the inevitable disruption of transportation and producing operations. Reverberations will roll back to every phase of the industry.

Thousands of nonunion oil workers are already idle, and many more will be forced off payrolls without the opportunity of expressing a preference. In some of the struck refineries the shutdown represents the will of a minority, emphasizing again the weakness of a national labor policy which permits a few to dictate action of a majority.

The labor difficulties are made more ironic by the fact that petroleum is among industries paying highest wages. Oil company employes enjoy scores of benefits in savings programs, health insurance, paid vacations, retirement bonuses and other forms of security. The general offer of an increase of 15 per cent in the basic oil wages is among the most liberal voluntary steps taken by any industry.

Conciliation efforts under way this week at Chicago are highly important. The industry is unable to meet union demands for an increase of 30 per cent in basic wages so long as price ceilings are applicable. There can be no denying the economic fundamentals involved. Higher wages can be paid only from greater earnings. Revenue is derivable only from sale of products.

In the final analysis the consumer must shoulder the cost of higher wages. These rudiments are common to all industry. Labor's demand for higher wages is the most serious threat to economic stabilization since the end of the war.

Aloofness of some companies in declining invitations to the Chicago conciliation conferences does not reflect lack of interest. The rejections came from companies which are free from labor disputes at the moment. There is a wholesome desire to remain removed as far as possible from Government pressure in labor relations.

Independent unions in many cases have accepted the voluntary increase of 15 per cent in basic wage rates. This indicates strongly that the CIO demand for 30 per cent higher wages is not as deeply seated in the minds of the workers as in the thoughts of union leaders.

Meanwhile, the conciliation discussions should be completely objective. Government representatives assigned to the oil dispute are thoroughly experienced. It is safe to assume that conciliators will give full consideration to the economic facts. The oil industry has conclusive evidence that earnings will be reduced until the peacetime machinery is running at high speed. The CIO wage demands are too sharp in the face of conditions which will prevail for at least a year.

Most companies have taken employe representatives into their confidence. Current and prospective earnings, the companies are able to show, argue strongly against a full 30 per cent increase. The outlook hardly justifies the voluntary increase of 15 per cent in base rates.

Wages never catch up with commodity prices in the inflation spiral. Workers should be the last group to promote inflation, for they are the most severely injured by this vicious economic phenomenon.

N.P.A. Meeting Considers Wages, Taxes, and Labor Relations

ATLANTIC CITY. — Maintenance of a high wage scale, the threat of an uncertain tax burden, and the complicating snarl of labor relations are three problems of grave concern to the American petroleum industry, trustees of the National Petroleum Association were told in a 2-day round-table meeting here September 20-21.

A group of Government and industry experts painted a picture of the political shape of things to come, and the consensus was that the industry is entering one of its most difficult periods. Some of the oil men who attended the sessions were frank to say that unless some solution is found to the "crisis economy" now developing, oil, like other American enterprises, faces a darkening future.

The burden which the Truman administration may demand that the petroleum industry help shoulder was sketched in the opening discussion, "Government and the Petroleum Industry," led by Sen. Joseph C. O'Mahoney, chairman of the Senate committee investigating petroleum resources. The first problem of the industry is the maintenance of its markets, he argued, through the prevention of unemployment and depression, and this is to be achieved, he said, by the preservation of high wage scales. Such a policy, said Senator O'Mahoney, is more than a one-industry matter; there are evidences that many nations are losing confidence in the democratic system of government, and both capitalism and democracy can be made to work only if we do not slip back into a "low-gear economy."

"It is a mistake for any industry to imagine it can serve the interests of capitalist economy by labor policies which result in low wages and long hours. Whenever you cut wages you cut profits because you cut purchasing power," the senator said, urging the retention of a high-speed economy.

Although Senator O'Mahoney paid high tribute to the petroleum industry for its contributions to the war effort, many of the oil men who heard him saw in his remarks the clue to an emerging administration policy that may seek support in its appeal to labor and other mass groups. One industry representative pointed out to Senator O'Mahoney that the problem of high wages is linked to prices and that the industry is hamstrung in its ability to pay high wages as long as inadequate ceiling prices prevail.

Arthur Pew, of Sun Oil Co., arose to ask the senator what help government had given business in the war that might be continued in peacetime. Senator O'Mahoney cited the antitrust law exemption. Another questioner asked: "Will the Government allow enough profits to keep our economy going?"

Fayette Dow, general counsel for N.P.A., who presided over the round-table, urged members "to start questioning a questioner and turn the tables on the senator."

In the give-and-take that followed the oil men made clear their belief that the whole burden of reconstruction could not be placed on industry and that American business had a right to expect equitable treatment from Government.

Ramifications of Labor Problem

The ramifications of the problem of labor relations were stressed by Vincent P. Ahearn, chairman of the industry members of the National War Labor Board, who said issues that would prove important in the immediate future included union recognition, grievance procedures, arbitration, seniority, and health programs.

The people will not condone industrial violence or a wave of strikes, he said. He urged that the petroleum industry prepare its statement for the forthcoming labor-management parley. He opposed industry-wide bargaining with labor as a method that gives "to one union leader power that he should not have".

The importance of a sound fiscal policy for the best operation of the petroleum industry was stressed by H. E. Humphreys, Jr., chairman of the finance committee of United States Rubber Co., and chairman of the tax committee of the National Association of Manufacturers. Business, he said, should not be expected to carry more than a 25 per cent tax load. He said that a survey by his group disclosed wide industry favor for the elimination of the excess-profits tax, but retention of the carry-back features of the law for postwar conversion. He revealed that the treasury has about decided to abandon plans for a change in the industry's depletion reserves program.

Industry must get a break in taxes, said Humphreys. "Business optimism can be killed by excessively high taxes, and I advocate tax cuts in the face of an unbalanced budget. We can't balance the budget solely at the expense of industry".

The crucial importance of the question of industrial economics and emerging Government policy was referred to in a number of other and purely technical discussions. One industry leader summed up the N.P.A. roundtable with the comment, "It looks like the future of our industry is as much dependent on the political as on the technological picture."

Egloff Leads Refining Discussion

Dr. Gustav Egloff, Universal Oil Products Co., Chicago, led the discussion on future refining techniques. Some of the latest developments in German synthetic fuel and lubricating-oil processes were disclosed by Dr. William C. Schroeder, Bureau of Mines, who headed a group of 22 technical experts that entered Germany immediately following the Allied armies last February. Scientific information on German oil plants was obtained by these men from records and documents out of plant files, and also by direct interrogation of technical men employed in these plants. Army and Navy petroleum requirements were discussed by Rear Adm. A. F. Carter, U.S.N., executive officer, Army-Navy Petroleum Board. Short and long-term economic trends in the industry were outlined by A. N. McIntosh, Socony-Vacuum Oil Co., Inc.

Egloff stated that although the first commercial catalytic cracking plant was started as late as 1937, over a million barrels of stock are now being charged daily to catalytic units. The trend in refining is toward the manufacture of purer hydrocarbons as raw stocks for the manufacture of higher-quality petroleum products, rather than starting from a heterogeneous mixture. Road performance is the best standard for evaluating motor fuel, but some companies are again stressing octane rating. One oil company is selling an aviation fuel at its service stations that has a 91-96 octane rating. Catalytic cracking will increase the yield of useful products from petroleum. Over 30,000 synthetic-rubber compounds were prepared during the war, and about 500 will have some peacetime uses. Butyl-rubber inner tubes will hold air 10 times better than those made of natural rubber. There will be an increasing demand for diesel and jet-engine fuels. Much research work is under way on these fuels.

Egloff deplored the Government policy of stripping our universities and technical colleges of students. Many countries are sending students to our engineering schools, and in

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FORECAST OF PETROLEUM REQUIREMENTS

General items considered—	1935-39	1941	1946	1947	1948	1949	1950
Population (millions)	129	133	140	141.2	142.4	143.6	144.8
Income payments (millions 1944 dollars)	84.4	89.0	100	.....	.....	.....	131.6
Consumer expenditures (millions 1944 dollars)	74	110.7	124	.....	.....	.....	109.6
Production, FRB Index	100	162.0	175	185.0	170.0	180	190
Items Directly Affecting Petroleum Consumption							
Passenger cars and buses—							
Avg. in use (1,000's)	24,262	28,741	26,235	27,425	29,250	32,000	35,000
Miles run	8,710	9,650	9,000	10,000	10,000	10,000	10,000
Miles per gallon	15	15	13.5	14.1	14.5	15.4	16.5
Unit consumption (bbl.)	13.8	15.3	15.8	16.9	16.4	15.5	14.4
Truck—							
Avg. in use (1,000s)	4,008	4,733	4,607	5,000	5,250	5,420	5,670
Miles run	10,060	11,500	11,000	11,500	12,000	12,000	12,000
Miles per gallon	9.0	9.0	9.0	9.2	9.3	9.6	9.8
Unit consumption (bbl.)	26.6	30.4	29.1	29.9	30.7	29.7	29.1
Home heating units	1,425	2,269	2,395	2,700	2,950	3,220	3,560
Per cent of total dwellings	4.4	6.4	6.5	7.3	7.8	8.2	8.8
Unit consumption (bbl.)	55.1	53.2	56.0	55.0	54.0	53.0	52.0
Domestic Petroleum Requirements (1,000 bbl. per day.)							
Motor fuel—							
Passenger cars and buses	919	1,206	1,137	1,269	1,316	1,355	1,384
Trucks	292	394	368	410	442	441	452
Aviation, civilian	....	31	48	60	70	82	94
Industrial naphtha and other non-highway	96	117	129	178	145	162	165
Military on-shore	....	....	125	110	100	100	90
Total	1,307	1,748	1,807	2,027	2,073	2,140	2,185
Kerosene	148	190	195	200	190	191	191
Distillates—							
Home heating	215	331	367	407	436	468	507
Diesel fuel	55	76	96	106	110	124	129
Industrial, etc.	35	54	48	76	68	60	61
Total	305	461	511	589	614	652	697
Residual—							
Heating	102	128	156	175	180	193	201
Industry and commerce	528	675	680	705	632	688	720
Vessels	181	155	178	181	185	189	192
Misc. & navy on-shore	49	93	201	201	174	166	160
Total	860	1,051	1,215	1,262	1,171	1,236	1,273
Lubricants—							
Automotive and aviation	33	41	42	47	47	47	48
Industrial oils	30	45	45	46	41	43	43
Total	63	86	87	93	88	90	91
Wax	2.9	5.2	5	5.1	4.1	4.6	5.0
All other products— (Including losses)	390	530	533	570	565	588	606
Total domestic requirements	3,076	4,071	4,353	4,746	4,705	4,902	5,047

many of them the foreign students now greatly outnumber American students. He asked how long could we expect to retain leadership in science and technology if we permit this absurd policy to continue.

Only about 10 per cent of the work of translating German reports has been completed to date, and it will be many months before all of the scientific information on the German oil industry obtained by Dr. Schroeder and associates will be available to American industry. High-quality lubricants and aviation fuels were manufactured in Germany by catalytic processes, but their costs of production may not be competitive in this country. Both liquid-phase and vapor-phase catalytic cracking processes were used in Germany, as well as hydrogenation. Many types of catalyst were employed. Millions of dollars were spent on the research work covered in the reports obtained by our experts sent into Germany.

About 80 per cent of the German aviation fuel was manufactured by hydrogenation in which ground coal is mixed with return oil, preheated to 450° F., hydrogenated under 300-700 atm. with tin oxide catalyst. The coal is depolymerized by the hydrogen. Gas and light oils are separated, and the heavy oils are centrifuged to remove solids, then used as return oil. Tin oxide is used as catalyst at 300 atm. and iron oxide at 700 atm. Aromatic content of fractions boiling above 85° C. was cracked in presence of a molybdenum catalyst, which produced octane rating from 70-80. Other catalysts, as combinations of molybdenum, chromium, and zinc sulfides produced 85-90 octane rating which could be increased to 95 with tetraethyl lead.

Extreme flexibility is permissible in the Fischer-Tropsch operations through temperature-range control and choice of catalyst. Synthetic lubes were of high viscosity index—170 for 6 Engler viscosity oils, and 115 for 3 Engler.

A. N. McIntosh estimated that there will be about 31.5 million passenger cars in use in this country by 1950. The number of trucks and buses will drop to the prewar level next year and then will show a continuous increase. Consumption of aviation gasoline will drop as military requirements decline, but by 1950 domestic consumption should reach 120,000 bbl. per day.

E. T. Knight, The Atlantic Refining Co., presented estimates of petroleum requirements as shown in the accompanying table.

Contractors' Meeting Is Scheduled for October 1

OKLAHOMA CITY.—The fifth annual meeting of American Association of Oilwell Drilling Contractors, Oklahoma City, October 1-2, will be featured by discussions of various problems confronting the drilling industry, including manpower, labor relations, safety, insurance, materials, and practices.

The various committees will meet October 1, and full reports will be made at the afternoon session. Committee meetings are open to all. Waldo Stephens, Oklahoma City, will preside at the afternoon session.

The annual banquet will be held Monday evening, with Gov. Robert S. Kerr of Oklahoma as toastmaster. The banquet will be proceded by a fellowship hour.

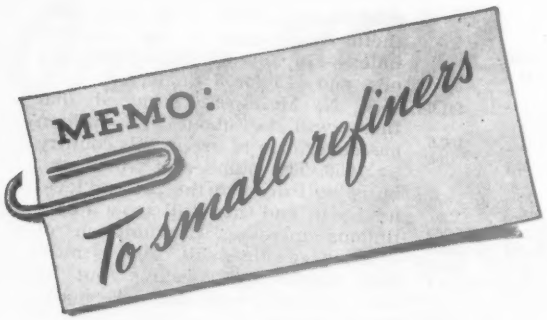
The morning session October 2 will offer papers on "Drilling Equipment Needs," by Douglas Ragland, Humble Oil & Refining Co., Houston; "Association's Accounting Program," by Leland Breckenridge, A. A.O.D.C., Dallas; "Safety in Drilling," by W. F. Burris and C. C. Weiss, Phillips Petroleum Co., Bartlesville, Okla.; and a paper on "Drilling Practices." Ralph W. Marshall, Los Angeles, will preside.

Officers will be installed at the luncheon October 2.

At the afternoon session October 2, P. H. Bohart, director of production, Petroleum Administration for War, Washington, will talk on "The Petroleum Outlook." Glenn A. Campbell, Glenn Drilling Co., Tulsa, will speak on "Adaptation of Contract Drilling to Peacetime Operations." Fred M. Mayer, Continental Supply Co., Dallas, will discuss "Equipment Delivery Prospects." C. W. Alcorn, Houston, will preside.

A barbecue at the Oklahoma City Golf and Country Club will be given at 6:30 p.m. by the Oklahoma City arrangements committee.

XUM



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Now small refiners can meet anticipated post-war octane requirements *with* catalytic cracking and *without* paying a penalty for the modest size of their operations. For Houdry has designed and engineered a small T C C unit (2000 b/d to 3000 b/d) which, through scientific simplification, will produce high octane gasoline as cheaply as much larger catalytic units.

The catalytic section of the small T C C unit illustrated is compact but complete. It includes all the essentials of cat crackers many times its size. And the simplifications which have been achieved in its design have not sacrificed efficiency. For example, there is only a *single elevator,* instead of two or three, and a common vessel serves as reactor and storage for hot catalyst.

Houdry Laboratories will gladly discuss this small T C C unit with interested refiners.

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FOR VICTORY IN WAR
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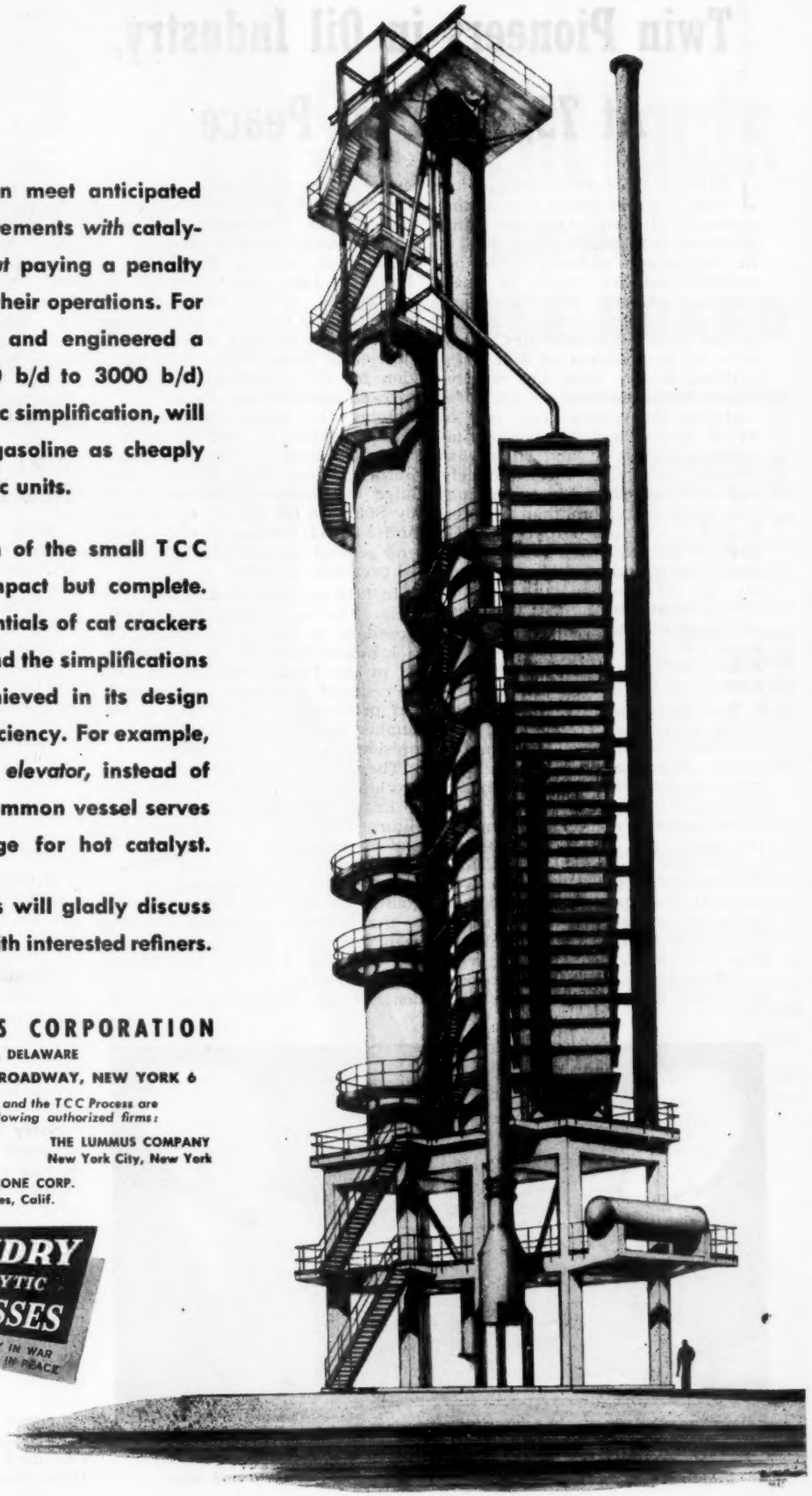


Twin Pioneers in Oil Industry, At 75, Plan for Peace

J EDGAR PEW and John G. Pew twin brothers whose outstanding careers in oil, natural gas, and transportation have made them two of the best-known pioneers in the petroleum industry, were 75 years old on September 27. They spent the day on the job, as usual, J. Edgar as vice president of Sun Oil Co., and John G. as president of Sun Shipbuilding & Dry Dock Co., wholly-owned Sun subsidiary.

During the second great war in which they helped supply the vital combination of oil and ships that speeded victory, J. Edgar actively supervised geophysical and production work that more than doubled Sun Oil's crude-oil output. John G. directed the expansion of Sun Ship and its construction of 40 per cent of all the oil tankers built in the United States during the war period, in addition to hospital and cargo ships, car floats for the invasion of Frnce, and extensive refinery equipment.

Now they are studying and supervising peacetime reconversion, and for them the problems have a familiar ring that dates from 1919. After the first World War their efforts resulted in a steady expansion of productivity and employment in the work they directed. A repeat performance today is a challenge too strong to resist, even at 75. Not even their closest friends would make the mistake of asking them when they thought they might retire.

J. Edgar and John G. were born September 27, 1870, at Mercer, Pa.; started their first jobs together, at the age of 16, with Peoples Natural Gas Co. in Pittsburgh; and until 1918 followed parallel careers.

After 10 years in Pittsburgh, J. Edgar in 1896 joined Sun Oil Co. at Toledo, where the company's first refinery had been acquired the year before. Packing a revolver he hurried to Texas to lay the foundation for the company's oil-producing and pipe-line operations.

John G., meantime, continued with Peoples. In 1892 he became superintendent of the company's Forbes Street shop. Eleven years later the company was purchased by Standard Oil Co. of New Jersey, and John G. became vice president and general manager. He was elected president in 1908.

In 1918 he joined Sun in Philadelphia. The next year he became president of Sun Shipbuilding Co.

J. Edgar, from 1901 to 1912, worked in the Texas oil fields. In 1913 he resigned to become an independent producer in Tulsa, but in December joined Carter Oil Co. as vice president and western manager.

The same year that his twin brother resigned from Peoples Gas, J. Edgar resigned from Carter and returned to Sun as vice president, and as president of the subsidiary Sun Pipe Line Co. of Texas. He was the first recipient of the gold medal for distinguished service to the petroleum industry awarded each year since 1936 by the American Institute of Mining and Metallurgical Engineers. He was president of the Mid-Continent Oil & Gas Association for 3 years, beginning in 1916, and was the second president of the American Petroleum Institute, serving in 1924 and and 1925. Last June he was selected as the oil industry's spokesman to present data on American petroleum resources to the Senate O'Mahoney Petroleum Investigating Committee.

J. Edgar married Miss Martha Layng in 1899, and they have three children, John G., George L. and Mrs. Martha Elizabeth White. He and Mrs. Pew make their home in Villa Nova, Pa.

John G. married Miss Eva Weitzel in 1896. They had 11 children, 8 of whom are living; Mrs. C. W. Worst, Mrs. Ben T. Burton, James E., Mrs. James W. Laws, Thomas W., J. Newton, John G., Jr., and Mrs. Richard S. Oakey.

Seventy-five-year-old twins, John G. and J. Edgar Pew, plan peacetime reconversion as they wind up outstanding war records in oil and ships

A.P.I. November Meeting Now Definitely Scheduled

NEW YORK.—Definite scheduling of the twenty-fifth annual meeting of American Petroleum Institute for November 12-15, at the Stevens Hotel, Chicago, was announced last week by W. R. Boyd, Jr., president

"Lifting of travel restrictions to conventions on October 1 removed the final barrier to holding this Victory Jubilee meeting," said Boyd.

New products, new markets, and enlarged opportunities for service will be subjects for discussion.

DEATHS

William J. Alexander, 53, manager for Halliburton Oil Well Cementing Co. at Big Spring, Tex., died last week.

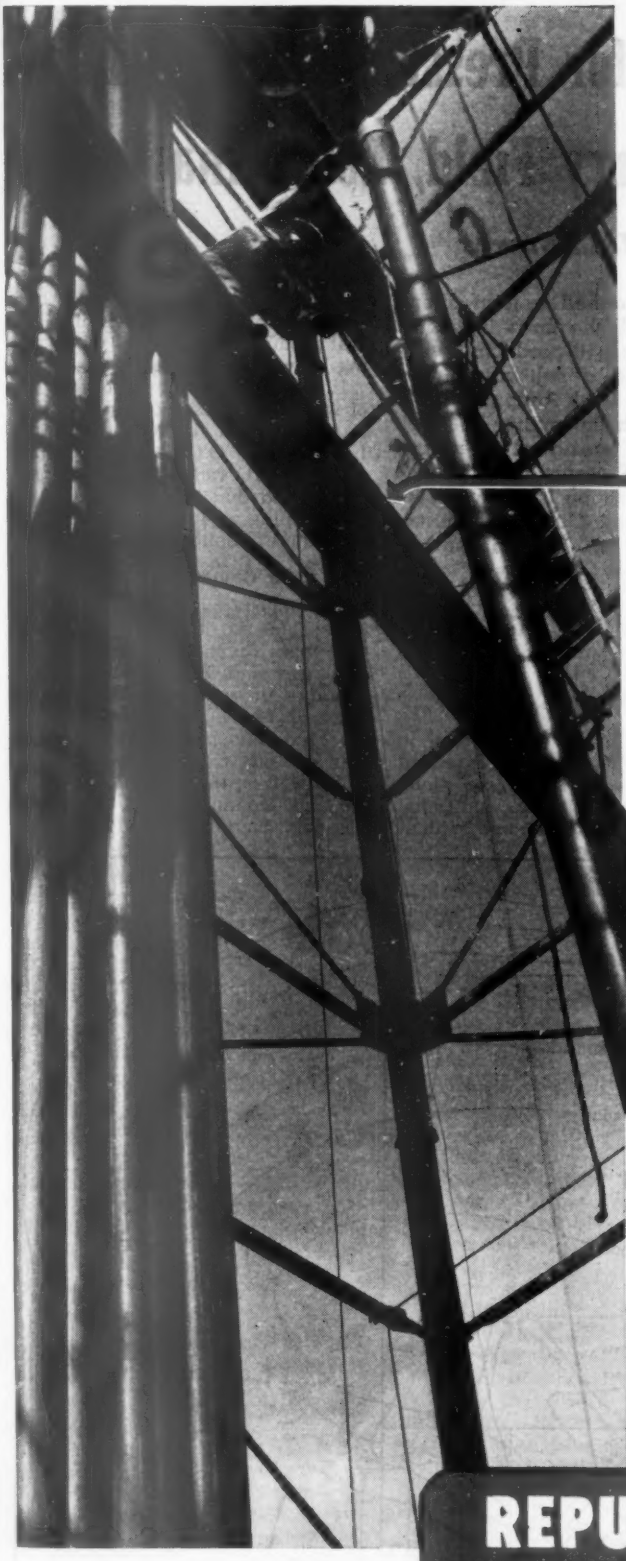
Herman Layer, 68, for 20 years an oil operator of California, died recently in Los Angeles.

John T. Callahan, 58, oil and mine operator in Texas for 25 years, died September 15 in Weslaco.

Harry J. Briggs, 60, superintendent of truck transportation for Cities Service Oil Co., died September 25 at Bartlesville, Okla., where he suffered a stroke. He had been employed by Cities Service since 1918.

Dr. Samuel Weidman, 74, professor of geology at University of Oklahoma since 1919, died September 22 in Norman, seat of the institution. Dr. Weidman formerly was a member of the University of Wisconsin faculty.

Legene S. Barnes, 41, vice president of Elbe Oil Land Development Co., died September 13 in Beverly Hills, Calif.



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Salt-Water Injection for Pressure-Maintenance In East Hackberry Field, Louisiana

by M. L. Euwer

Here is described a joint operation in which the three interested parties pooled 10 producing wells and installed a salt-water injection system, with Union Sulphur Co., of which the author is assistant to vice president, operating the project. Pressure maintenance by water injection is a recent development for a Gulf Coast piercement dome, and thus of extreme interest.

THE East Hackberry field is a piercement-type salt dome located in Cameron Parish in southwest Louisiana. Oil production was first discovered on this dome in 1927 and since that time several oil-productive sand reservoirs have been developed on top and on the flanks of the dome.

The main Camerina sand reservoir with which this article deals is of Oligocene age and is located on the south flank of the dome as indicated on the field map, Fig. 1. The sands of this reservoir have been pierced by the salt and dip away from the dome at a steep angle.

Discovery and Development

Production was first established in the Camerina sands on the south flank of the dome by Union Sulphur Co. 9 Mary Doiron. It was completed on October 13, 1938, with an initial production of 931 bbl. per day of 31-gravity oil on a 3/16-in. choke, 3,600-lb. tubing pressure and a gas-oil ratio of 695 cu. ft. per bbl. The producing interval in this well is 7,068-97 ft.

Following the discovery of oil in this zone, development was extended east and west from 9 Doiron along the flank of the dome. As additional wells were drilled it became evident that the Camerina sands had been separated by radial faulting into several productive reservoirs with varying oil-water contacts.

In addition to the east-west line of wells drilled along the upper limit of the sand, Union Sulphur Co. 1 Josephine O'Quinn was drilled some 700 ft. radially outward and established that the productive sand was dipping away from the dome at an angle of about 55°.

Main Camerina Reservoir

The most extensive productive fault block to date is herein called the "main Camerina reservoir." The structure map, Fig. 2, shows the location of the wells completed in this reservoir and is contoured on top of the First Camerina sand. The reservoir extends from Union Sulphur's 7 Caldwell on the west to Abercrombie and Magnolia's 2 I. Doiron on the east having a total length of

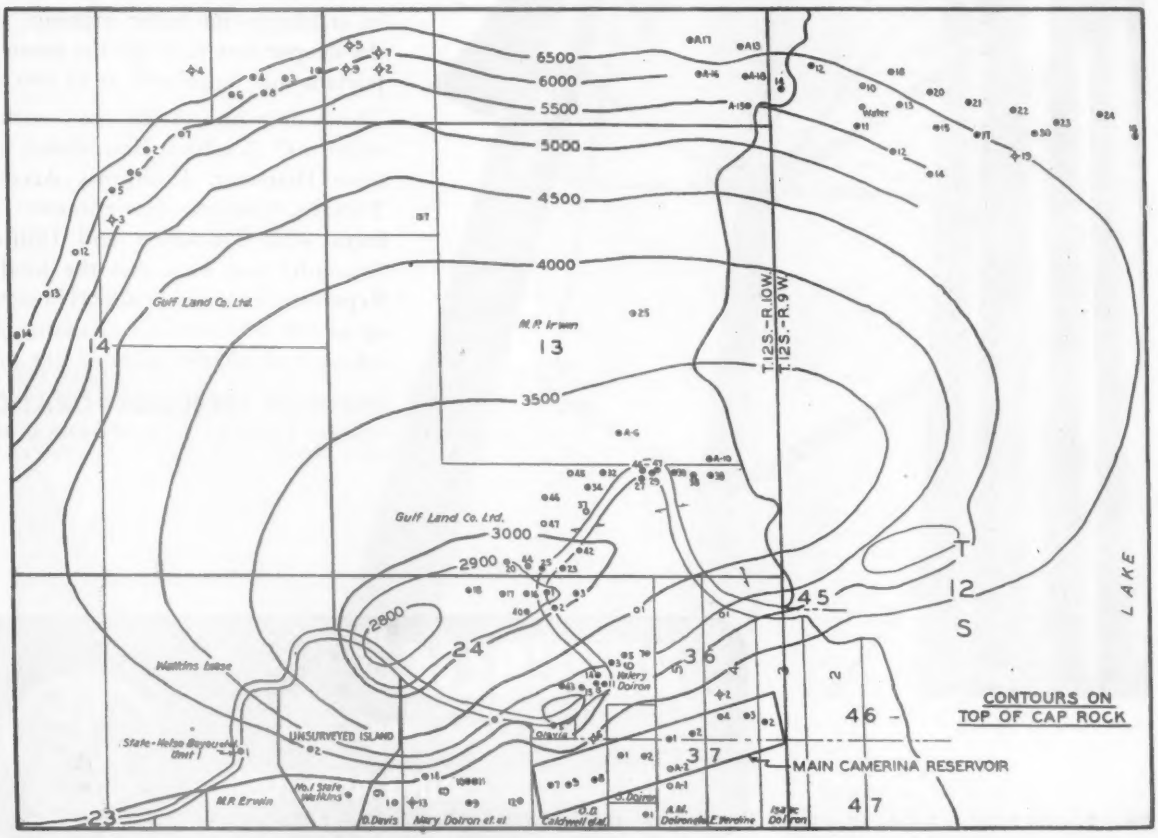


Fig. 1—Map of East Hackberry field, Cameron Parish, Louisiana. Contoured on 500-ft. intervals

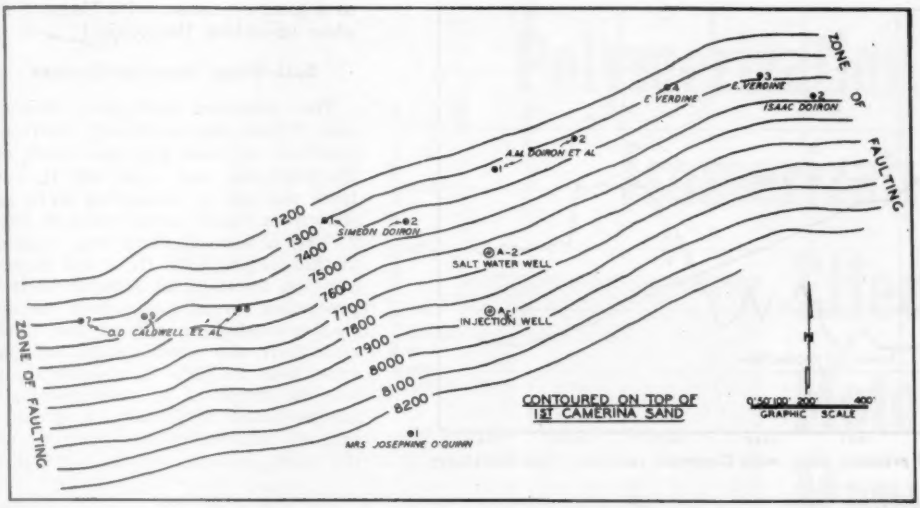


Fig. 2—Main Camerina reservoir, south flank, East Hackberry field

about 3,100 ft. Ten producing wells were completed in this reservoir, five belonging to Union Sulphur, and five belonging jointly to J. S. Abercrombie Co. and Magnolia Petroleum Co. The depths of these wells range from 7,208 to 7,485 ft. with the average depth of the 10 wells being 7,326 ft. Good evidence is available from electrical logs, water levels, and pressure data to show that this reservoir is separated from the wells producing to the east and west.

The producing sand is well developed and has a thickness of approximately 100 ft. The porosity is around 30 per cent and permeability ranges from below 1,000 to as high as 13,900 millidarcys. The down-dip extent of the oil accumulation in this fault block was definitely limited by the Josephine O'Quinn well which topped the sand at 8,187 ft. Cores of the sand in this well contained good oil shows but a test resulted in salt-water production. The attitude of the producing sand with respect to the salt plug is indicated in Fig. 3.

Production and Pressure History

Union Sulphur's 7 Caldwell, the initial producer from the main Camerina reservoir, was completed in January 1939. The total oil production from the reservoir from that date up to March 1, 1945, was 3,554,561 bbl. or an average of 1,884 bbl. per day. During this period the daily production ranged from 500 to 2,500 bbl. as shown on the graph in Fig. 4. The original gas-oil ratio was 695 cu. ft. per bbl.; however by March 1945 it had declined to 480 cu. ft. per bbl. due to gas coming out of solution in the reservoir. The reservoir pressure history is shown on the graph in Fig. 4. The initial pressure at a depth of 7,265 ft. was 5,255 lb. This was some 2,000 lb. above the pressure normally expected for that depth. The reservoir pressure declined at a fairly uniform rate for the first 2 years and during this period there was an average of 617 bbl. of oil produced per pound pressure drop. At the end of the period, the pressure had dropped to 3,925 lb., the indicated saturation or bubble point for the oil. From that time on to March 1945 when the reservoir pressure reached 2,707 lb., there was a marked flattening in the pressure decline curve, probably due to gas coming out of solution. During this period there was an average of 2,241 bbl. of oil produced per pound of pressure drop. However, the rate of pressure decline was still about 20 lb. per month or 1 lb. per 3,000 bbl. of oil produced in March 1945 when salt-water injection got under way in a satisfactory manner. At that time all of the wells were still flowing but the tubing pressures were rather low, ranging from 300 to 600 lb.

Pressure-Maintenance Project

During the latter part of 1943, it became increasingly evident that the reservoir did not have an effective natural water drive and that with the pressure declining around 20 lb. per month, it would be necessary to start lifting the wells artificially some time in the latter part of 1945. Also it was quite certain that if the pressure was permitted to go on down, there would be a considerable amount of otherwise recoverable oil left in the sand. Consequently, discussions were started among the three interested companies, Union Sulphur, Abercrombie, and Magnolia, as to the advisability of installing a salt-water injection system to maintain the pressure and increase the ultimate recovery of oil.

Several conditions seemed to make this reservoir ideal for pressure maintenance and artificial water

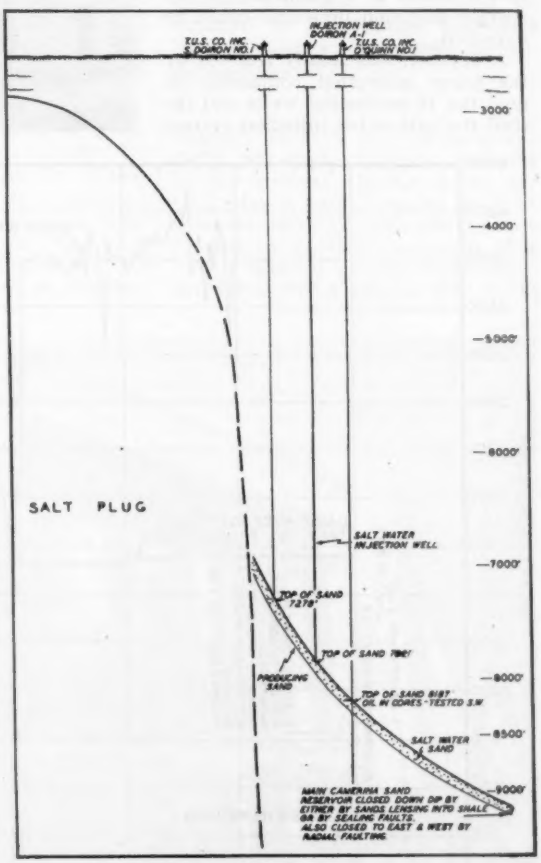

INJECTION WELL DOIRON A-1
T.U.S. CO. INC. S. DOIRON NO.1
T.U.S. CO. INC. O'QUINN NO.1
3000'
4000'
5000'
6000'
SALT PLUG
SALT WATER INJECTION WELL
7000'
TOP OF SAND 7278'
TOP OF SAND 7361'
PRODUCING SAND
8000'
TOP OF SAND 8187' OIL IN CORES - TESTED S.W.
SALT WATER SAND
8500'
MAIN CAMERINA SAND
9000'
RESERVOIR CLOSED DOWN DIP BY EITHER BY SANDS LENSING INTO SHALE OR BY SEALING FAULTS. ALSO CLOSED TO EAST & WEST BY RADIAL FAULTING.

Fig. 3—East Hackberry Dome—cross section showing main Camerina producing reservoir on south flank of dome

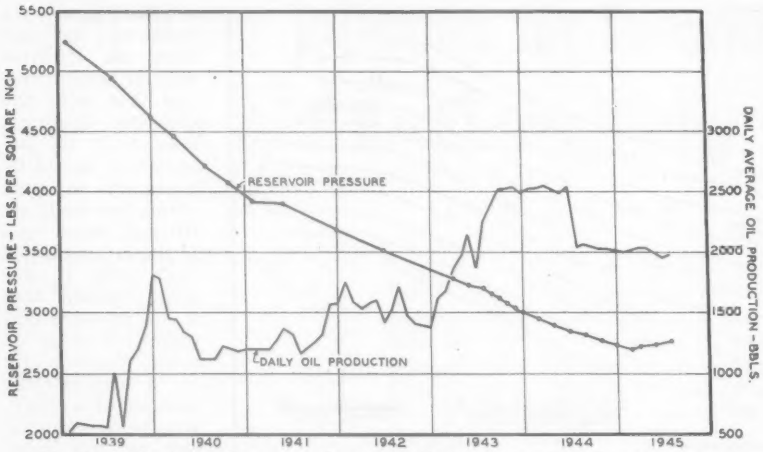


Fig. 4—Production and pressure data, main Camerina reservoir, East Hackberry

drive. The steeply dipping sand would permit injection of the water several hundred feet below the average producing depth of the wells and thereby minimize the possibility of serious water coning because of the differences in specific gravity of the salt water and oil. Highly permeable sand conditions were indicated by uniform pressures throughout the reservoir and by high well potentials. Also the formation pressure had declined to a point where low surface injection pressures could be expected.

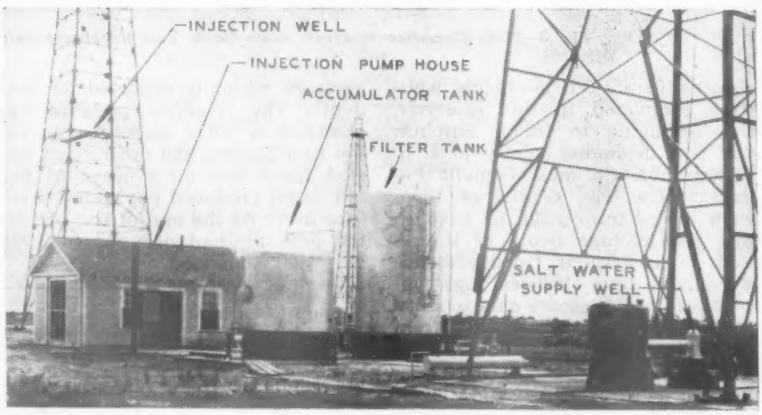
A decision was finally reached by the three interested companies to pool the 10 producing wells and install the salt-water injection system as a joint operation with Union Sulphur operating the project.

Salt-Water Injection System

The injection well, A-1 Doiron, was drilled approximately midway between the east and west ends of the reservoir and some 400 ft. out from the line of producing wells as shown on the structure map in Fig 2. The producing sand was topped in this well at 7,821 ft. or 495 ft. below the average total depth of the producing wells. Seven-inch casing was cemented on top of the sand and then the entire sand section from 7,821 to 7,920 ft. was cored. It was the intention to underream all of the sand and make a gravel-packed completion but because of the hard character of the sand, underreaming was very slow and difficult. Finally, a bit was stuck at 7,845 ft. after underreaming the hole from 7,821 to 7,845 ft. to an average diameter of 14 in. Consequently it was decided to complete the well in this upper section of sand. This was done by gravel packing a 3½-in. Layne & Bowler 0.020 gage wire-wrapped screen with 31 sacks of gravel. The job was completed on January 10, 1945, at which time the well was placed on gas lift and flowed 400 bbl. of salt water per day to backwash the gravel pack and clean the drilling mud from the sand face. Gas lifting was continued at intervals until February 15 when salt-water injection was commenced. The well showed a slight trace of oil while backwashing, indicating probably that the oil-water contact was near that point.

A shallow well, A-2 Doiron, was drilled to produce salt water for the injection system. Ten and three-quarter-inch casing was set and cemented in this well at 1,520 ft. and

(Continued on page 131)



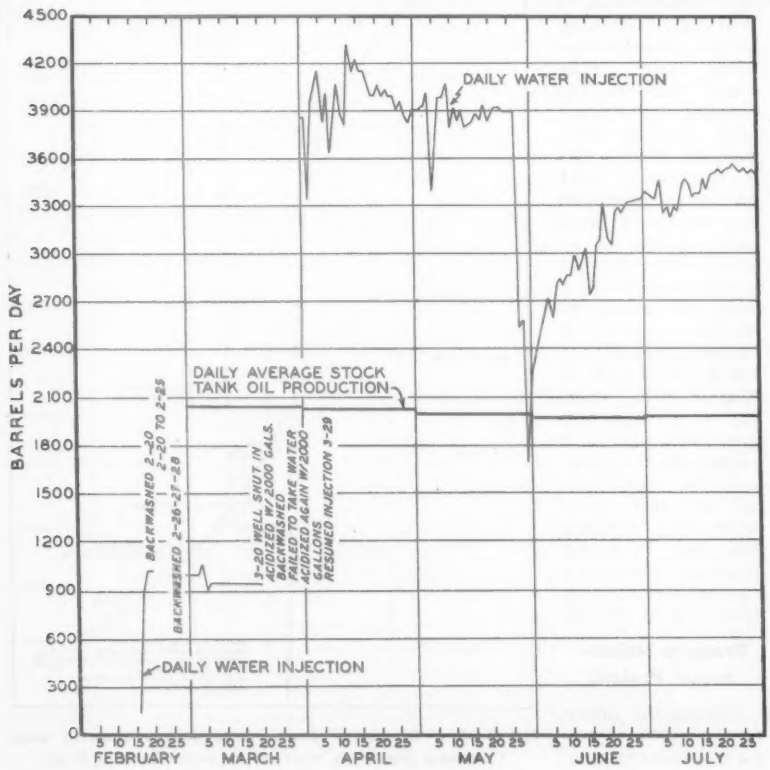
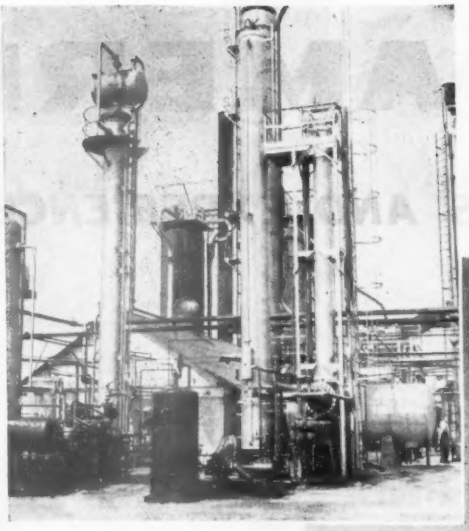
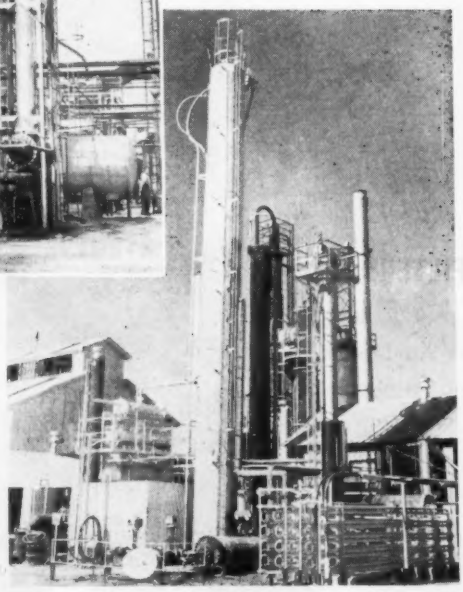


Fig. 5—(Left) Daily oil production and water injection, main Camerina reservoir.
Fig. 6—(Above) Arrangement of surface equipment of injection system

Polymerization and Isomerization Are Effective in Motor-Fuel Manufacture





Above: Bareco Refining Co.'s U.O.P. polymerization unit, Wichita, Kans.

Right: The reboiler of the codimer fractionator is seen in lower foreground, heat exchanger at right. Tower in middleground is a Girbotol desulfurizer. Plant is that of Sunray Oil Co., Allen, Okla.

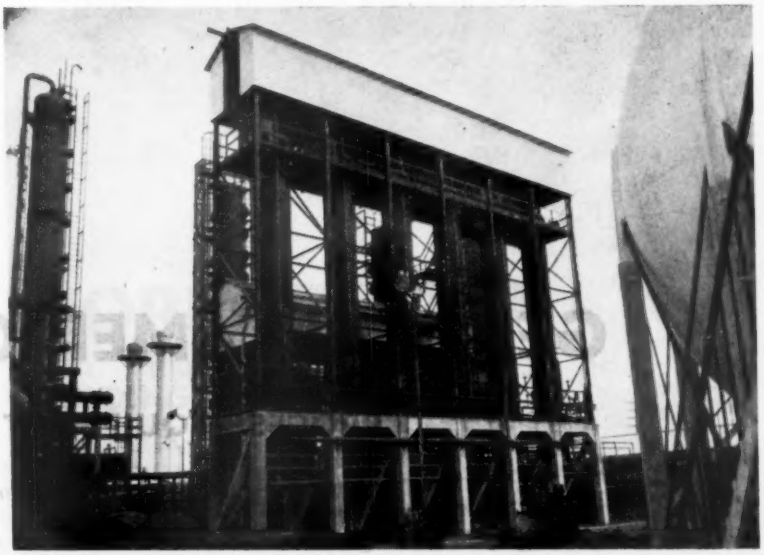
by Arch L. Foster

PART 3 OF A SERIES

Phosphoric acid has come to be our best-known polymerization catalyst in terms of quantity of material produced. Silica and alumina are also recommended as polymerization catalysts. Aluminum chloride is proposed as catalyst to polymerize isoolefins to form heavy lubricating oil hydrocarbons.

POLYMERIZATION of olefinic hydrocarbons, especially light low-boiling products to reduce vapor pressure without simultaneously reducing octane rating too severely, has been practiced for several years, starting on a large commercial scale in the 1930's with the development of supported phosphoric acid as catalyst for promoting reaction between refinery cracked gases. Phosphoric acid, supported on magnesium sulfate or other carrier materials which are themselves essentially inert catalytically, has been developed by Ipatieff and Universal Oil Products Co., while others contributed to its application commercially in greater or lesser degree during the ensuing years. It had the timely ability to improve the total yields of gasoline in the range of permissible vapor pressures, and at the same time to supply a few per cent of a high antiknock blending stock, at a time in the industry's history when improvements of both were of paramount importance.

Subject to certain poisons this catalyst is protected, says Nelson (3-165), treating the charge stock with a portion of spent phosphoric catalyst to remove these poisons before the charge is brought into contact with the main body of (fresh) catalyst of the same kind. A German researcher uses zinc pyrophosphate dissolved in H_3PO_4 to polymerize olefins at 200° C. (392° F.) (3-166). Another inventor (3-169) recommends cobalt pyrophosphate as a polymerizing catalyst at "elevated pressures" and 400°-450° F. It will be remembered that cobalt oxide or cobalt are used as Fischer-Tropsch catalysts to prepare essentially paraffinic reaction products by the synthesis. Layng (3-170) impregnates a porous carrier such as granular charcoal with the residue formed by heating a solution of a metal ammonium pyrophosphate—as copper—for a time at 750° F., to



U.O.P. butane isomerization plant, Avon, Calif., refinery of Tide Water Associated Oil Co.

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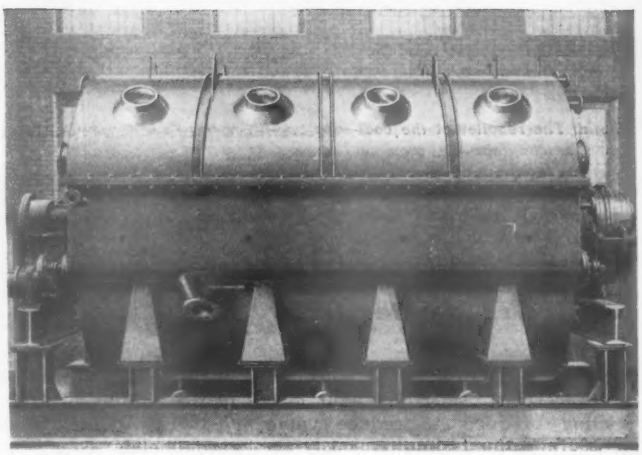

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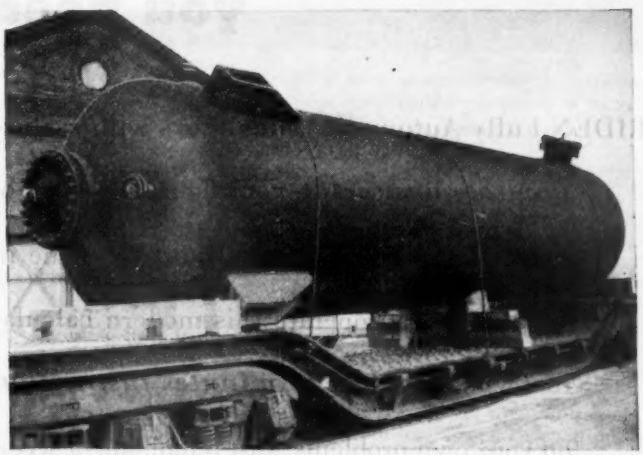

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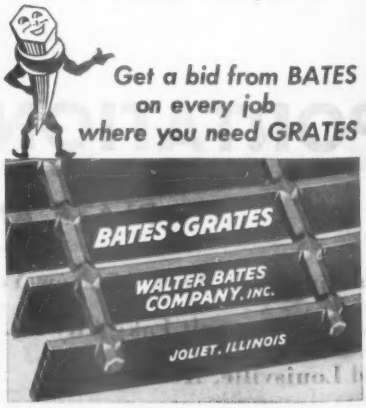
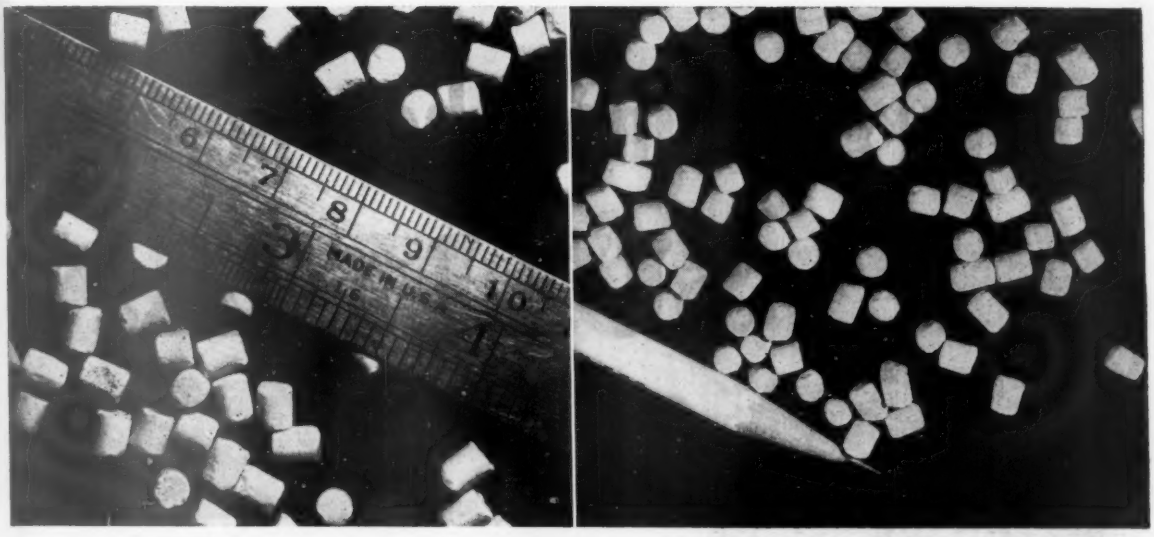




Catalysts are pelleted for use in many processes, as shown here. Left: New catalyst of natural clay, montmorillonite or similar material, for catalytic cracking or other refinery processes. Right: regenerated catalyst of the same type, ready for returning to the reaction zone. (Courtesy Filtrol Corp.)

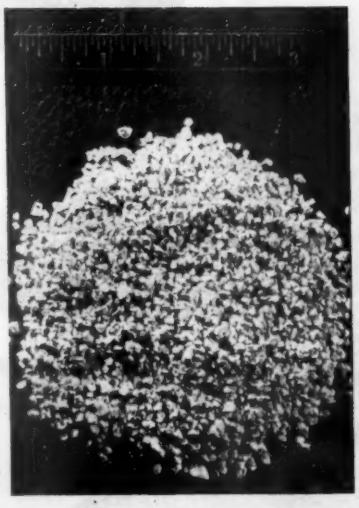
remove the ammonium group, and treating olefins with this supported catalyst at 150 psi. and 300°-600° F. A variation of this plan is to mix together coarsely powdered charcoal, carbon, or coke with one or more metal pyrophosphates such as those of Hg, Co, Cu, Zn, Mg, Fe, or Al, finely divided (3-171). These catalytic materials so combined must be free from SiO_2, Al_2O_3, clays, etc., another patent claims (3-175).

Addition of water as catalyst promoter or to hasten reaction was discovered early in the history of phosphoric acid polymerization. A recent patent advises the use of phosphoric acid on quartz, pumice, or clay (3-177), at 410°-475° F. and 700 psi., adding water in small increments at several points in the reaction system so as to add a total of 3 weight per cent of water by the time the reaction mixture reaches the exit point of the reaction zone. Illustrating another carrier a polymerization catalyst of phosphoric acid, H_3PO_4, is used to impregnate kieselguhr (diatomaceous earth) of 200-400 mesh (3-179).

A complex polymerization catalyst (3-182) is recommended, containing phosphoric acid, $Cu_3(PO_4)_2$, $Ca_3(PO_4)_2$, in proportions ranging from 4:1:1, to 8:1:1, is made from bone ash which contains 90 per cent of the Ca salt, with Cu_2O, and H_3PO_4. It is possible that the solids in this catalyst may serve in part as carriers for the acid, but more likely they may tend to maintain the phosphoric ion concentration present in the catalyst and thus maintain the catalyst's effectiveness. A somewhat similar catalyst is made of H_3PO_4 mixed with finely divided copper metal (3-185), which doubtless will give some copper phosphate during use of the catalyst. Another assertedly effective catalyst is made (3-163) by treating blast-furnace slag with HCl or H_3PO_4 until it is nearly all dissolved, then precipitating a gel, and washing and drying it.

Silica, Alumina Catalysts

Several catalysts are claimed by different researchers, composed of solids such as silica, alumina, etc. A water-insoluble silicate containing a catalytically active basic element is dissolved in acid solution in which the gels of the silicate and the basic element are precipitated, washed, and dried (3-164). Activated bentonite (3-167) is also used, or



Isocel isomerization catalyst 8-14-mesh bauxite with 15-20 per cent aluminum chloride in Shell process. (Courtesy Attapulgus Clay Co.)

Al_2O_3 "supported" on silica, for polymerization of lighter materials to make synthetic lubricating-oil hydrocarbons. For a general rearrangement of molecular structure a cracking catalyst and a polymerization catalyst (3-168) are employed in the same zone to induce reactions by which various end results are claimed. Silica and alumina are also used as depolymerization catalysts presumably under different operating conditions from those used for polymerization. With Al_2O_3 present in amounts of 0.5-2.0 per cent on SiO_2 the depolymerization reaction is carried out at 550°-1,050° F. and at pressures below 100 psig. For direct polymerization (3-183) "hydrous silica and alumina" are claimed by Stevens. Small amounts of Al_2O_3 and oxides of Zn or Cd (Group 2) are mixed with major portion of SiO_2 for polymerization catalysis.

Anhydrous aluminum chloride further demonstrates its versatility as a catalyst by inducing polymerization under suitable conditions. Combination catalysts for converting ethylene to lubricating oils by polymerization (3-162b) include $AlCl_3$ plus nickel metal, or better, with Cu metal. Use of an autoclave with iron walls does not affect the reactivity. The use of tungsten, molybdenum, or nickel chlorides along with finely divided Ni or other metal such as Cu does not improve the results. A German development (3-172) employs for rapid polymerization 67 per cent sulfuric acid, promoted by 2 per cent of $AgSO_4$, silver sulfate, at 25°-30° C. The olefin enters the catalyst through a porous plate immersed in the acid, in order to form an intimate mixture, an emulsion, of olefin and acid catalyst.

(Continued on page 131)

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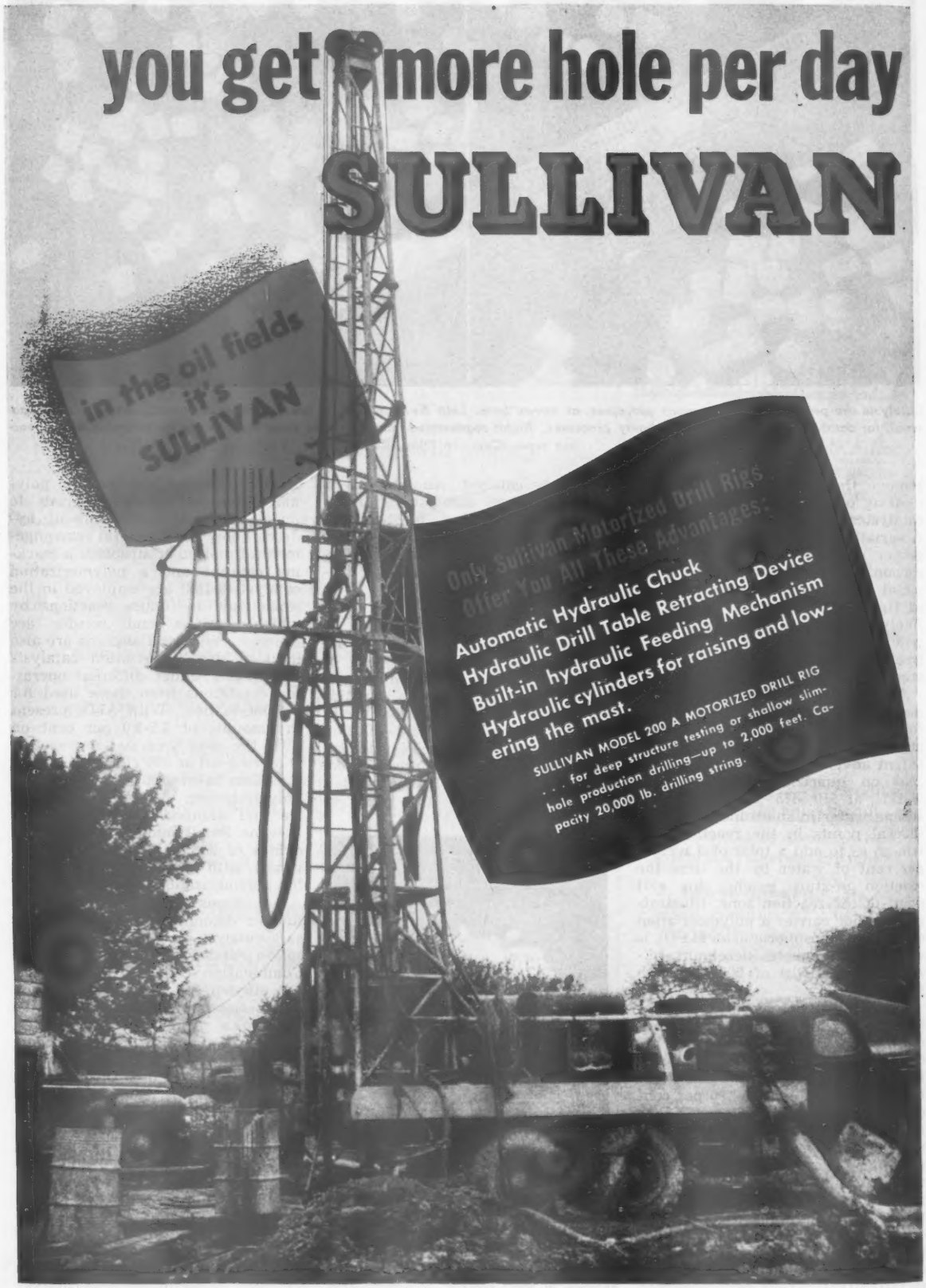
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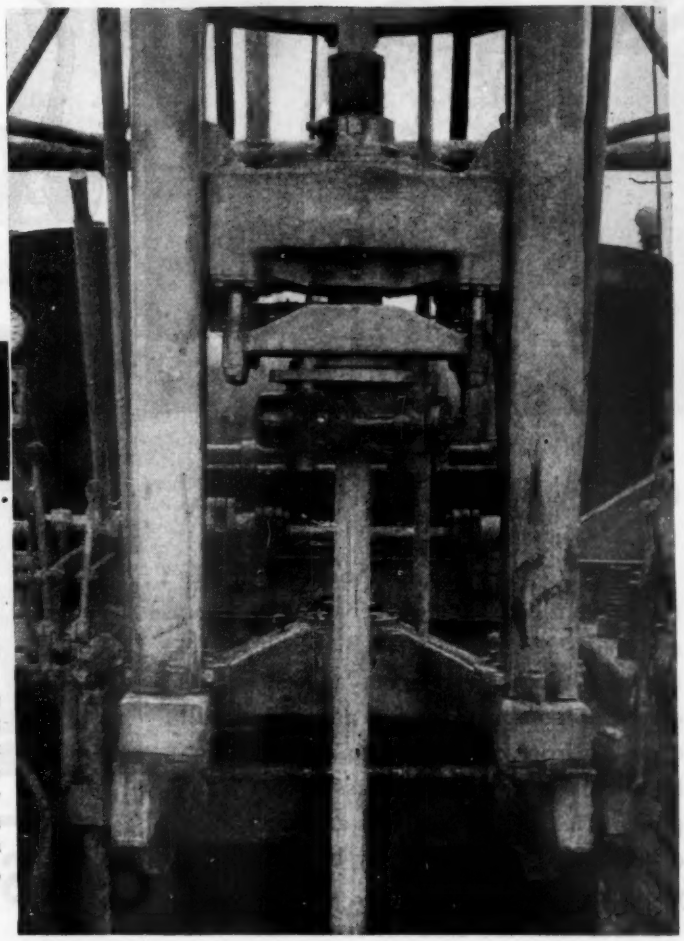

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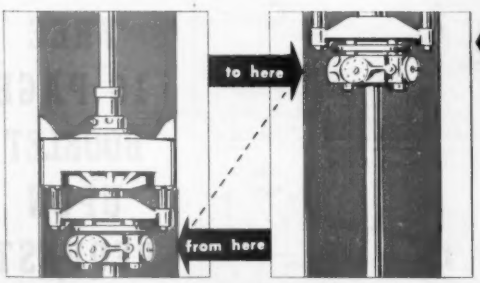

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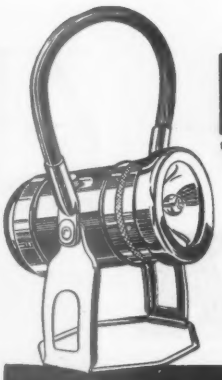

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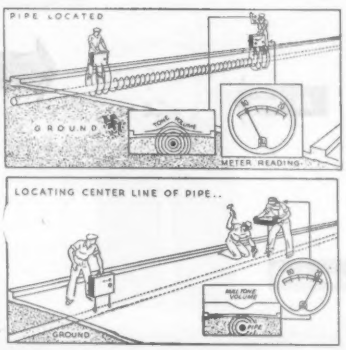

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Well Producing Capacity and Reserve

*by Park J. Jones**

THE OPTIMUM RATE OF PRODUCTION

PART 5 OF A SERIES

OPTIMUM rates of production vary with investments. Other things equal, investments in reservoirs depend on well-producing capacity. The well-producing capacity for a reservoir declines with a decrease in the number of producing wells and with a decrease in per-well producing capacity. The relationships between well-producing capacity and reserve are characterized by reserve raised to some power p. Cycling and pressure maintenance projects may be defined by small values of p. Production of oil by evolved solution gas may be defined by values of p which are large compared to those for cycling operations. The relationship between well-producing capacity and the reserve for a given reservoir depends primarily on producing and operating methods. If wells are produced at capacity, the relationship between well producing capacity and time may be obtained from that reserve and well producing capacity. Some of the relationships found in practice are illustrated graphically in this article.

Well Capacity vs. Producing and Operating Methods

SUPPOSE the rate of production from a reservoir does not exceed the MER. Under this condition, the initial reserve is said to be invariant with respect to rates of production provided producing and operating methods are fixed. Denote the initial reserve relative to fixed producing and operating methods by unity. Then the well-producing capacity V of most reservoirs is defined approximately by

$$V = V_o (1 - C)^p \qquad (1)$$

where V_o is the initial well-producing capacity in M.c.f.'s per M.c.f., or barrels per barrel, per year of an invariant initial reserve. C is cumulative recovery in M.c.f.'s per M.c.f., or barrels per barrel, of an invariant initial reserve. V is the well-producing capacity at the time the cumulative recovery is C. The exponent p depends on producing and operating methods. Its value may range from about 0.1 for some cycling and pressure-maintenance projects up to about 4.0 for some reservoirs in which oil is displaced by evolved solution gas. The value of the exponent p is not necessarily uniform throughout the entire life of a given reservoir. On the other hand, the value of p can be decreased by injecting gas or water into reservoirs.

The initial well-producing capacity V_o depends on the number of wells and the average initial per well producing capacity. The initial well-producing capacity varies widely as between reservoirs. It may be anywhere from about 5 per cent per year of an initial reserve up to more than 30 per cent per year of an initial reserve. Comparatively high initial well-producing capacities are commonly associated with reservoirs from which oil is produced by evolved solution gas.

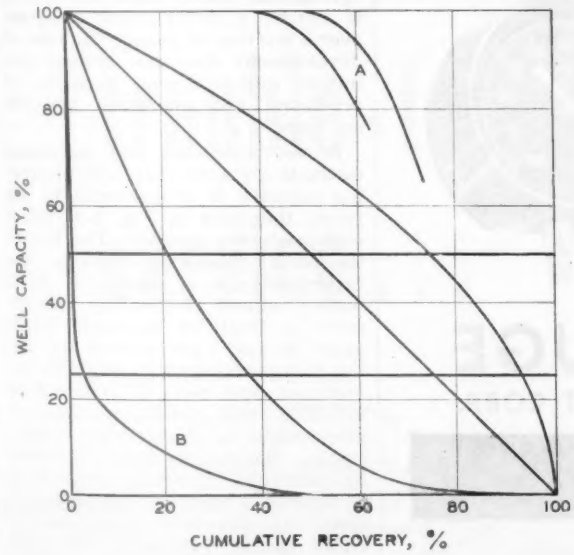
Irrespective of its value, denote the initial well-producing capacity V_o by unity. Then Equation 1 may be written as follows:

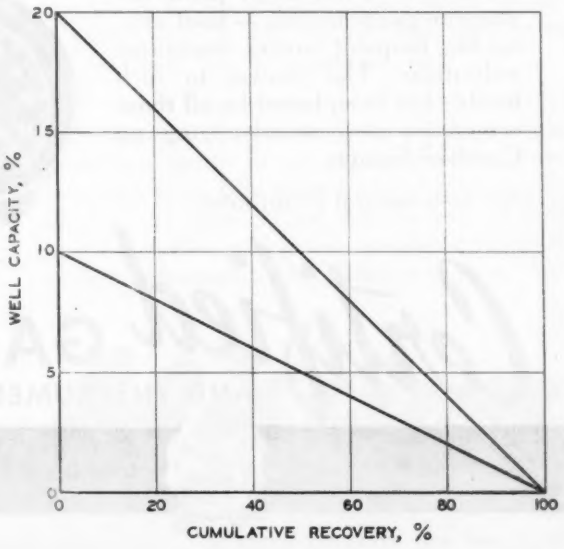
$$V = (1 - C)^p \qquad (2)$$

The well-producing capacity V is now expressed as a fraction of the initial well-producing capacity. Fig. 5-1 contains some solutions of Equa-

*Production consultant, Houston.

Fig. 5-1—(Left) Well-producing capacity in per cent of initial well producing capacity vs. cumulative recovery in per cent of initial reserve; curves A for cycling and pressure maintenance projects; curve B for undersaturated oil reservoirs; horizontal lines are uniform rates of production in per cent of initial well producing capacity. Fig. 5-2—(Right) Well-producing capacity in per cent per year of an initial reserve vs. cumulative recovery in per cent of initial reserve; well producing capacity is proportional to reserve





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tion 2. Well-producing capacity, in per cent of the initial well-producing capacity, is plotted against cumulative recovery. The straight line sloping at 45° across the diagram corresponds to p = 1. The upper continuous curve is for p=0.5. The first curve below the straight line is for p=3.0. Curves A are for cycling or pressure-maintenance projects. Curve B represents some undersaturated oil reservoirs. The horizontal lines represent uniform rates of production from reservoirs in per cent of initial well-producing capacity.

Well Capacity Proportional to Reserve

Consider a reservoir for which well-producing capacity is proportional to reserve. For this condition, p = 1 and well-producing capacity V is defined by

$$V = V_o (1 - C) \qquad (3)$$

The lines in Fig. 5-2 are solutions of Equation 3 for 10 and 20 per cent per year initial well-producing capacity.

As all wells for a given reservoir are not placed on production simultaneously, the initial well-producing capacity probably should be called the "potential" initial well-producing capacity. As here used, the initial well-producing capacity refers to what the well-producing capacity would be at zero cumulative recovery. If no wells were produced until all wells were completed, the rate of production from all the wells produced at capacity would be the initial well-producing capacity for a reservoir. In practice, the drilling of wells for a given reservoir may be spread over a period of several years. From the viewpoint of optimum rates of production and optimum investments, it may be advantageous under some conditions to extend a development program over a number of years. The rate of development does not change the initial well-producing capacity if producing and operating methods are fixed.

If the producing and operating methods are such that well-producing capacity is proportional to reserve, the lines in Fig. 5-2 define well-producing capacity. The higher the initial producing capacity, the faster the rate of decline if wells were produced at capacity. The reserve is small at economic limits equal to, say, 1 per cent of the initial well-producing capacity. The investment and methods required to maintain well-producing capacity proportional to reserve vary considerably. Natural-gas reservoirs may be controlled by some combination of number of wells and a compressor plant. An oil reservoir may require either gas or water-injection wells

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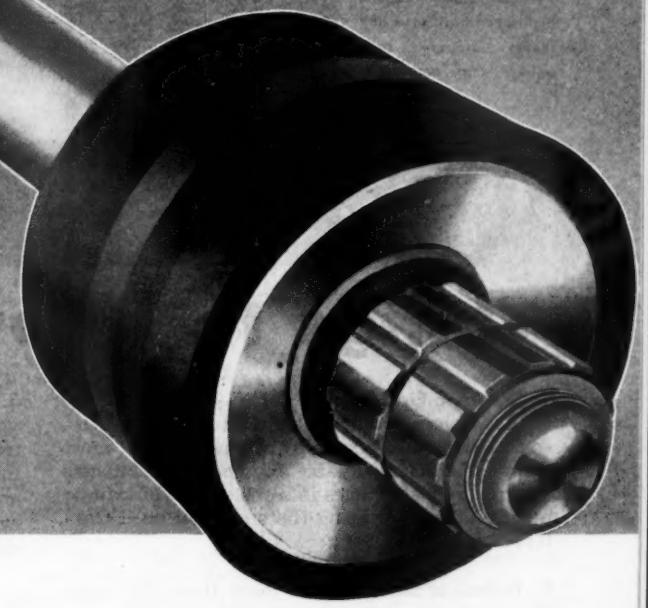

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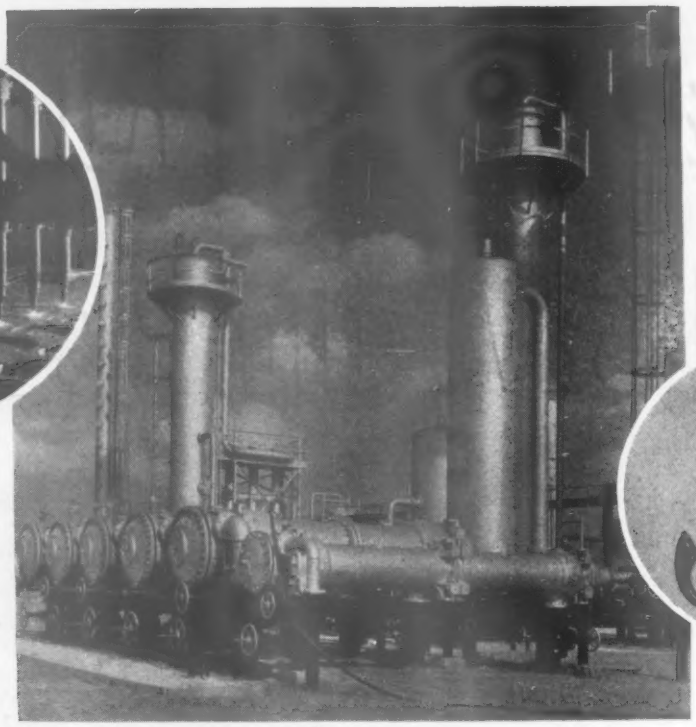

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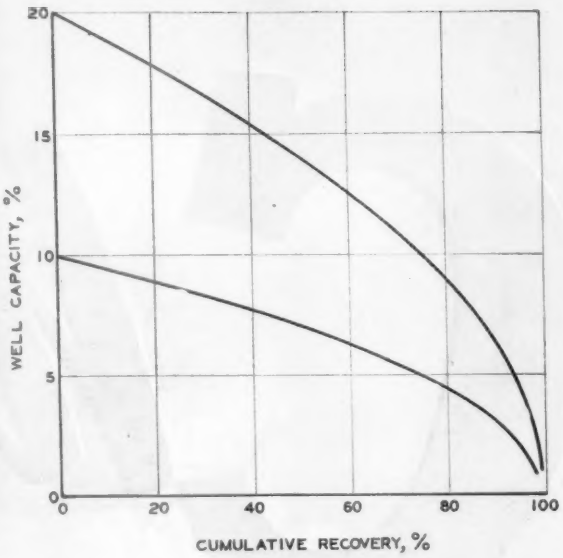

Fig. 5-3—(Above) Well-producing capacity in per cent per year of initial reserve vs. cumulative recovery in per cent of initial reserve; well-producing capacity is proportional to square root of reserve

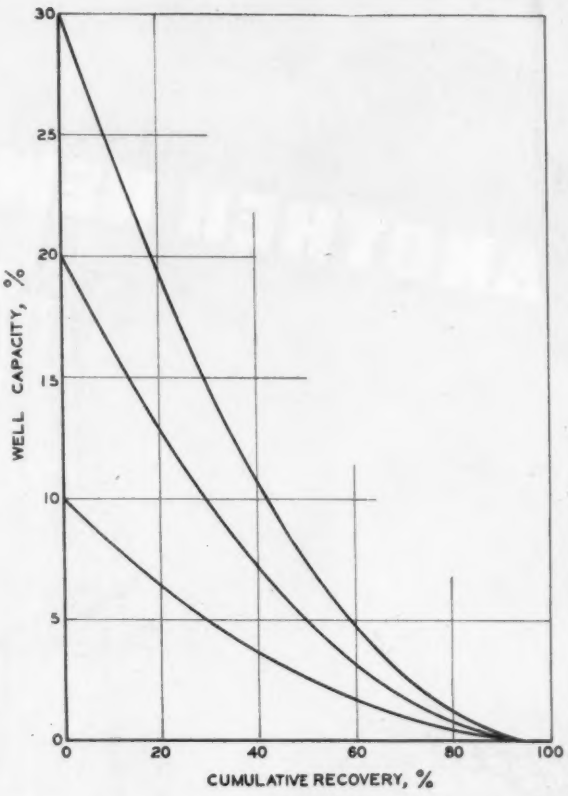

Fig. 5-4—(Right) Well producing capacity in per cent per year of initial reserve vs. cumulative recovery in per cent of initial reserve; well producing capacity proportional to square of reserve

rather than additional producing wells.

Suppose we apply producing and operating methods to a reservoir such that well producing capacity is proportional to the square root of reserve. For this condition p = 0.5 and well-producing capacity is defined by

$$V = V_o (1 - C)^{0.5} \qquad (4)$$

The curves in Fig. 5-3 are solutions of Equation 4. Well producing for 10 and 20 per cent initial well-producing capacity is plotted against cumulative recovery. The decline of well-producing capacity increases in this example. The smaller the remaining reserve, the faster the rate of decline. Well-producing capacity is maintained during the early life of a reservoir but is followed by comparatively rapid rates of decline toward abandonment. The reserve is small at economic limits equal to, say, 1 per cent of the initial well-producing capacity. Maintenance of well-producing capacity like that shown in Fig. 5-3 is usually limited to reservoirs for which pressure decline is comparatively small. Cycling and pressure-maintenance projects may have these characteristics. The comparatively rapid decline toward abandonment is caused by contamination of production by displacement fluids[3].

The well-producing capacity for a reservoir declines with a decrease in the number of producing wells and with a decrease in per well producing capacity. Pressure decline in oil reservoirs may cause a comparatively rapid decline in well-producing capacity. Pressure decline below the saturation pressure for oil is accompanied by a decrease of effective permeability to oil and an increase of viscosity. The combined effect of declined pressure, decreased effective permeability, and increased viscosity may result in a comparatively rapid decline in well-producing capacity. Suppose the decline in well-producing capacity is proportional to the square of reserve. For this condition, p = 2 and well-producing capacity V is defined by

$$V = V_o (1 - C)^2 \qquad (5)$$

The curves in Fig. 5-4 are solutions of Equation 5. Well-producing capacity in per cent per year of initial reserve is plotted against cumulative recovery. We might note the following characteristics: (1) A rapid initial decline of well-producing capacity, (2) a comparatively slow rate of decline at abandonment, and (3) well-producing capacity may approach an economic limit before 100 per cent of an initial reserve is recovered. In the case of reservoirs containing an oil having a saturation pressure which is on the order of only a few hundred pounds, economic limits may be approached along some such path as is illustrated by the B curve in Fig. 5-1.

The foregoing considerations are examples of only a few of the relationships found in practice between well-producing capacity and reserve. We will see later that optimum rates of production vary with investments in reservoirs. Other things equal, investments depend on well-producing capacity. If we were to maintain, say, a 5 per cent per year rate of production for 10 years, the well-producing capacity during the tenth year would have to average 5 per cent of the initial reserve. The investment required to provide this producing capacity varies as between reservoirs. The method of providing well-producing capacity may depend only on the number and location of wells. But, more commonly, some combination of producing wells and plant facilities can be employed more advantageously. Compressor, cycling, gas-injection, and water-injection plants are here considered as necessary producing facilities.

Well-Producing Capacity vs. Time

If the rate of production from reservoirs is equal to well-producing capacity, we can plot well producing capacity against time. The curves in Fig. 5-5 are illustrative examples. Well producing for a 10 per cent per year initial well-producing capacity is plotted against time in years. Three curves are included. They correspond to the data in Figs. 5-2, 5-3, and 5-4.

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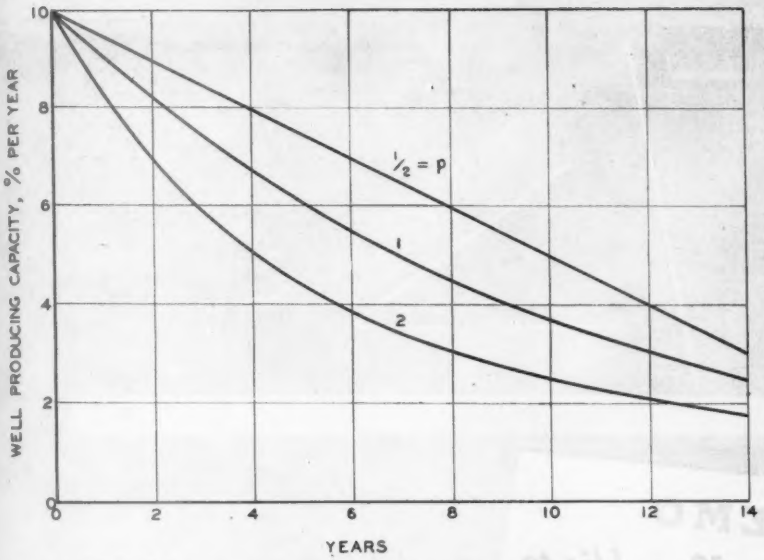

Fig. 5-5—Well-producing capacity vs. time and exponent p for 10 per cent per year initial well-producing capacity

The relationship between well-producing capacity V and time n in years for well producing capacity proportional to the square of reserve is defined, see the appendix to this article, by

$$V = \frac{V_o}{(1 + V_o n)^2} \qquad (6)$$

The bottom curve in Fig. 5-5 is a solution of Equation 6 for V_o, the initial well producing capacity, equal to 10 per cent per year of initial reserve.

The relationship between well-producing capacity and time for well-producing capacity proportional to reserve is defined by

$$V = V_o e^{-V_o n} \qquad (7)$$

where the symbol e is a constant and equal to 2.718. The middle curve in Fig. 5-5 is a solution of Equation 7 for initial well-producing capacity equal to 10 per cent per year of initial reserve.

The relationship between well-producing capacity and time for well-producing capacity proportional to the square root of reserve is given by

$$V = \frac{V_o}{2}(2 - V_o n) \qquad (8)$$

The top curve in Fig. 5-5 is a solution of Equation 8 for 10 per cent per year initial well-producing capacity. The middle curve is of particular interest in practice. Rates of production from reservoirs which are proportional to reserve represent a uniform rate of depletion. A uniform rate of depletion is a uniform rate of production decline. This particular rate of production decline is a convenient standard for the purposes of comparing the producing characteristics of reservoirs.

References

1. The Oil and Gas Journal, November 4, 1944, p. 53.

Appendix to Article 5

For wells produced at capacity, the rate of increase of cumulative recovery dC with respect to time dn is equal to the rate of production, that is,

$$\frac{dC}{dn} = V = V_o (1 - C)^p$$

from which

$$\frac{dC}{(1 - C)^p} = V_o n$$

For p = 2,

$$\frac{1}{1 - C} = V_o n + 1,$$

$$1 - C = \left(\frac{V}{V_o}\right)^{0.5}$$

and Equation 6 is obtained upon eliminating C. For p = 1,

$$1 - C = e^{-V_o n} \qquad \frac{V}{V_o} = 1 - C$$

and Equation 7 is obtained upon eliminating C. For p = 0.5,

$$2(1 - C)^{0.5} = -V_o n + 2,$$

$$1 - C = \left(\frac{V}{V_o}\right)^2$$

and Equation 8 is obtained upon eliminating C.

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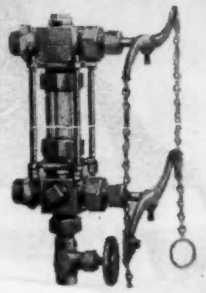

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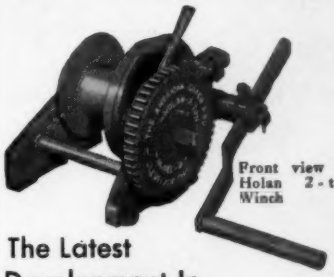

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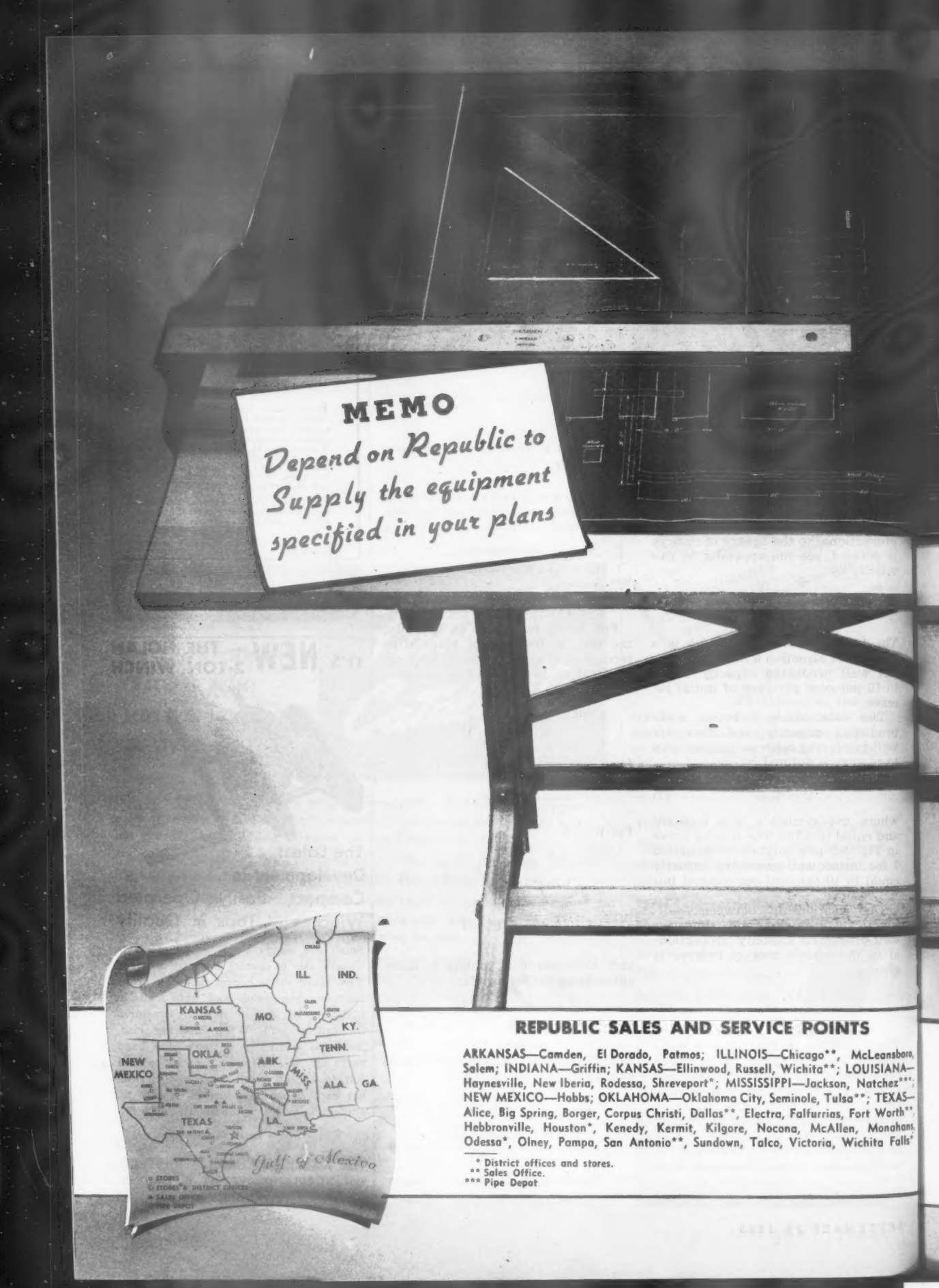

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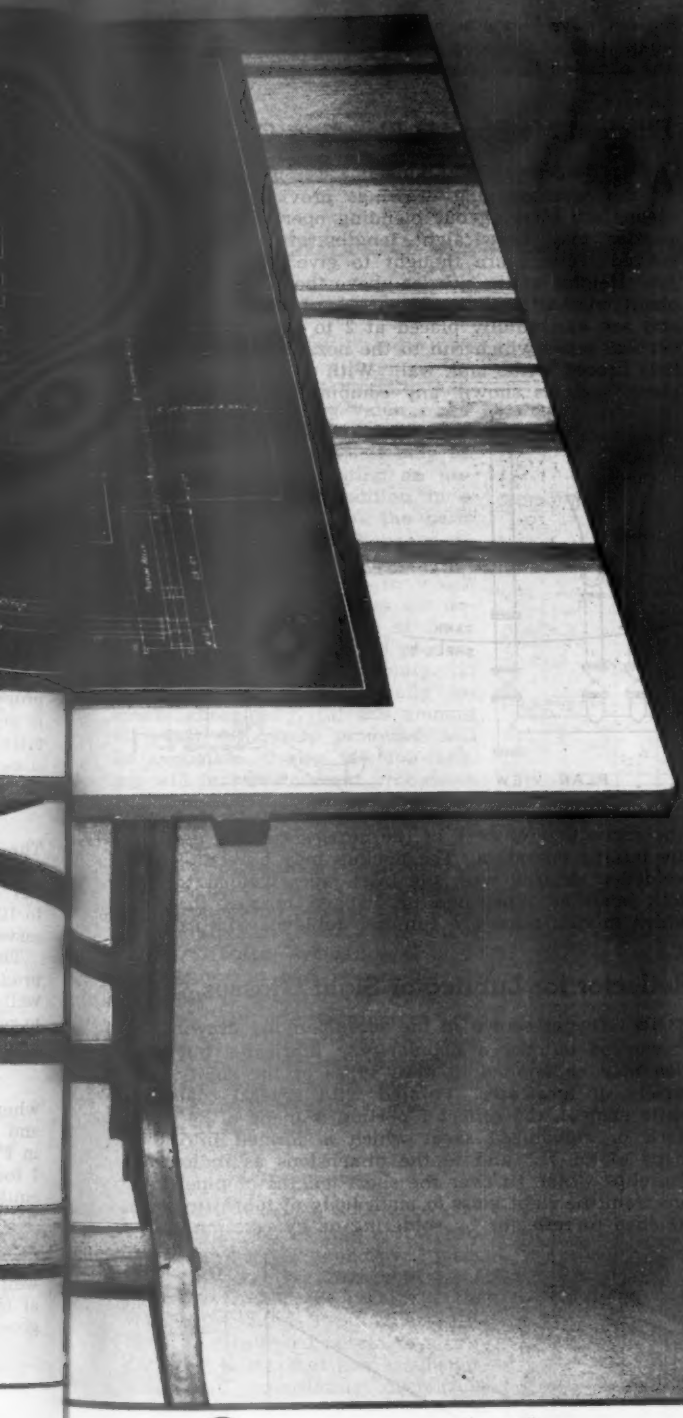

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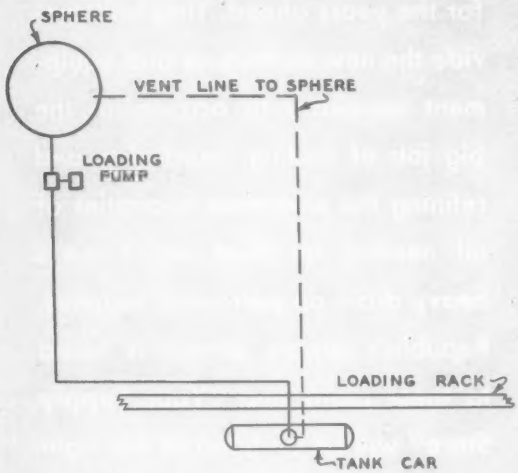
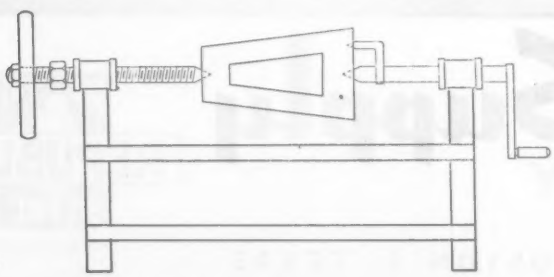
BY running a small vent line from a tank car, which is to be filled with products from a pressure storage tank, to the pressure tank, a substantial savings in vapor losses may be realized. If the vent line is properly sized according to the loading pump's discharge rate and



pressure the arrangement also provides the means for indicating to the operator when the tank car has been filled to the point where the vent line is connected into it. A pressure gage placed at some convenient location in filling line and near operator will show increase in pressure when liquid enters vent line.

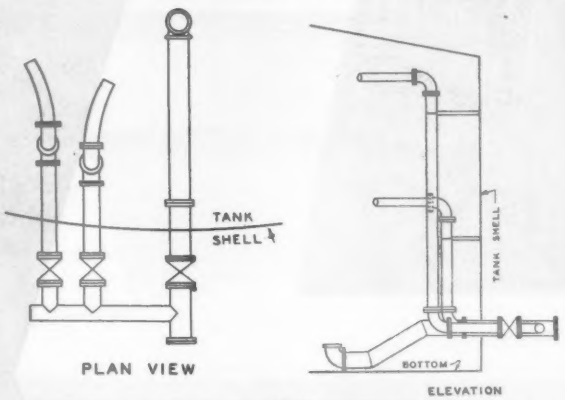
Holding Fixture for Valve Plugs

A SIMPLE fixture for use in hand finishing the surfaces of valve plugs after the plug has become worn, is shown in the accompanying illustration. The drawing shows the arrangement for a hand-rotated fixture but if desired power for turning the valve plug may be taken off of a line shaft or by individual motor drive when stepped down to the desired speed. Fabricated by welding, the fixture may be made of odds and ends, much in the manner illustrated. Although the fixture shown is for handling valve plugs which do not have stems as an integral part of the plugs, an adaptation of the idea may be worked out for handling the common-type plugs.



Efficient Method for Blending Operations

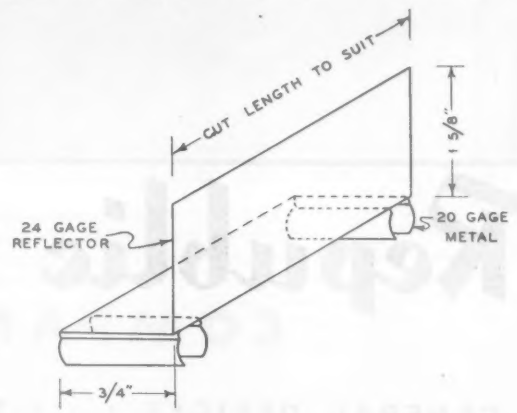
AN arrangement of mixing nozzles such as shown in the accompanying drawings provides an efficient means for carrying out blending operations. The two nozzles may be straight lengths of pipe; however, curved sections are thought to give a better mixing job. Heights of the nozzles above the tank bottom run about one-half and three-quarters of the tank's height and are horizontally placed at 2 to 3-ft. centers. Both vertical pipes which run to the nozzles should be suitably braced to the tank wall. With a manifold arrangement, such as shown, any combination of the filling



line and either or both of the nozzles may be used in the mixing operation. The hookup may be completely welded if desired with the inlet pipes welded to the tank shell as illustrated or flanged nozzles through which mixing pipes are run into tank may be used.

Reflector for Lubricator Sight Glasses

THE reflector shown in the accompanying drawing is worked out for a popular-type lubricator but the idea may be applied to most types of the sight-glass variety of lubricator. Painted with several coats of white enamel, the reflector portion is made of 24-gage black or galvanized sheet which is formed into the shape of an "L" and to the dimensions as indicated. The clips which fit over the short lengths of pipe that run from the sight glass to main body of lubricator are attached to reflector by soldering or by riveting.



The ideas described here are from Humble Oil & Refining Co. refineries

Significance of Declining Productivity Index

by C. V. Millikan and Herbert Beardmore†*

ABSTRACT

Declining productivity index, as considered herein, is a productivity index that has a substantially and consistently decreasing value when measured over a period of a few hours. If not recognized, it may be interpreted as representing an unsettled or unstable condition in a producing well. It forms the basis of a number of predictions as to future performance compared with the performance of wells in which the productivity index does not decline. The most important of these are that: (1) the rate of oil production will decline more rapidly, (2) the gas-oil ratio will usually increase abnormally, (3) the amount of water ultimately produced will be negligible, if any, (4) stop-cocking will increase current production and decrease gas-oil ratio. When such relative well performance is indicated, it follows that certain reservoir performance and operating practices may be anticipated: (1) disappointing recovery, (2) longer natural flow, (3) no active water drive, (4) better evaluation of acidizing, shooting and reworking, (5) intermittent operation of wells, (6) smaller pumping equipment required. It is significant that the basis of these important predictions is bottom-hole pressure tests that can be made immediately after completion of the wells.

Introduction

"PRODUCTIVITY index" is the number of barrels of oil produced per day per pound per square inch of differential pressure between the reservoir and the bottom of the well. "Declining Productivity Index," as considered herein, is a productivity index that has a substantially and consistently decreasing value when measured over a period of a few hours.

Productivity index can be determined only when the rate of production can be stabilized. In most wells the rate of production and bottom-hole pressure are easily stabilized to give a constant productivity index for a period of many hours. A few produce so erratically as to preclude probability of an acceptable test in the usual sense. A satisfactory productivity index can be determined in some wells only by gaging the production accurately by hours, measuring the bottom-hole pressure continuously, and from these data calculating the productivity index for successive hours. Such figures frequently will have a decreasing value—that is, a declining productivity index—and when plotted on double logarithmic cross-section paper with productivity index as ordinate and time as abscissa will be a straight-line curve. The angle between the curve and the abscissa is referred to as the rate of decline.

Declining productivity index may appear to be the result of change in permeability to oil due to decreasing saturation of oil and increasing saturation of gas in the reservoir. It is possible that such is in fact the cause, but if so, more is involved than merely relative saturation of oil and gas. This seems evident because the rate of decline in productivity index is substantially the same regardless of the production

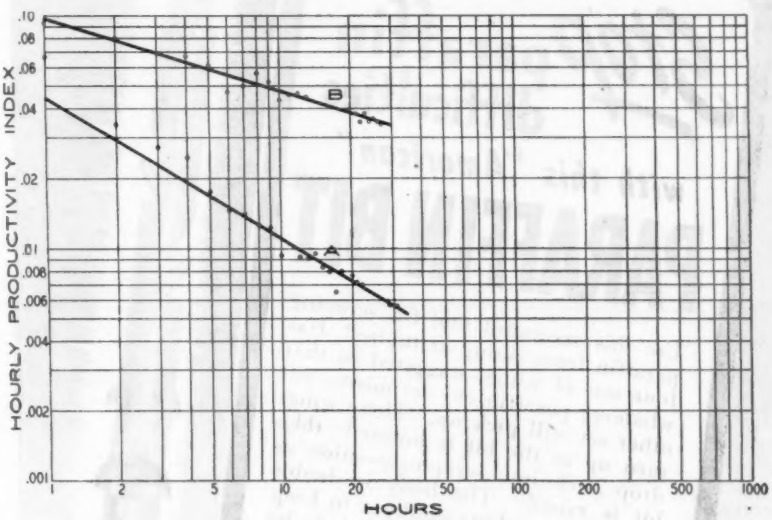


Fig. 1—Declining productivity index of two Gulf Coast salt-dome wells, normally expected to be producing from a water-drive reservoir

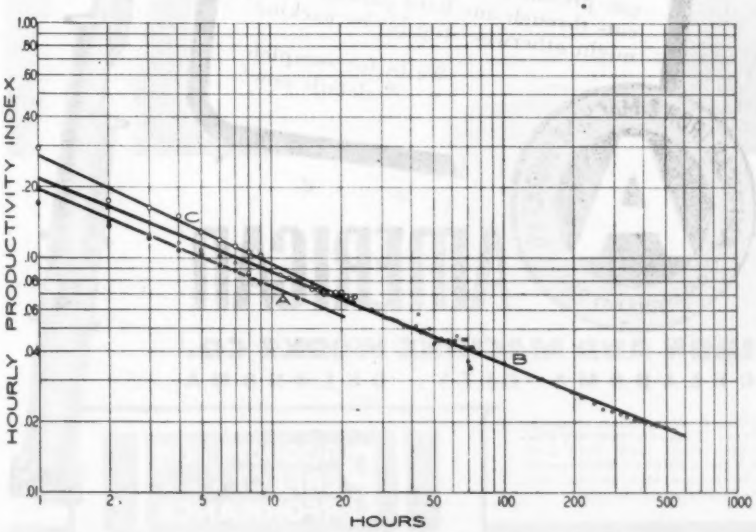


Fig. 2—Same rate of productivity index decline at different rates of production, and continuation of decline on a long test; restoration of productivity index during shut-in of well

*Amerada Petroleum Corp., Tulsa. †Barnsdall Oil Co., Tulsa. (Formerly with Amerada Petroleum Corp.)

Note—Paper presented at A.I.M.E. meeting in Houston, May 1944, and in the July 1945 issue of Petroleum Technology.

rate, and regardless of whether the flowing bottom-hole pressure is above or below the bubble point. Furthermore, during a test the gas-oil ratio increase is generally small, if any. It is believed that a reservoir characteristic, probably a type of porosity, is basically responsible for the type of declining productivity index discussed herein.

Significance of Declining Productivity Index

The history and performance of many wells having a declining productivity index have been sufficiently consistent to make certain qualitative predictions as to future performance of such wells seem reasonably safe, compared with the performance of wells that have a similar reservoir thickness, productive capacity, and other conditions, but do not have a declining productivity index. These predictions of relative performance may be summarized as: (1) the rate of oil-production decline will be more rapid, (2) the gas-oil ratio usually will increase more rapidly and reach a higher value, (3) the amount of water produced ultimately will be small, if any, (4) productivity index will be restored when the well is produced again after having been shut in.

A well having a declining productivity index will usually show a decline in production during the first hours it is produced if the rate of production approaches capacity. The production decline continues and in many cases the well will ultimately go completely dry of oil but still produce gas. There is no period in the life of the well at which the production rate may be called "settled." Such conditions mean low ultimate recovery. This, as stated above, is only relative to the recovery that would be estimated based on the conditions known early in the life of the well without benefit of knowledge of the declining productivity index.

An increasing gas-oil ratio is normal when the primary recovery agent is gas. Experience has been that in most fields the gas-oil ratio becomes even higher in wells with a declining productivity index. Because of the higher gas-oil ratio, wells produce by natural flow to a lower rate of production, and the time that artificial lifting equipment must be installed is delayed. A well does not ordinarily produce at a greater rate when artificial lifting is started than the rate at which it had been producing by natural flow, so that the lifting equipment need not be larger than required to lift the quantity of oil currently produced. The rate of production decline may be less for a few weeks, after which the decline is resumed at the same rate, or only slightly lower, than before.

Water has not been produced in an appreciable quantity from a well having a declining productivity index. Therefore, a pool in which the wells have a declining productivity index would not be expected to have an active water drive. This prediction would influence estimation of reserves, development of the pool and selection of well equipment.

Restoration of productivity index when a well is shut in is characteristic of wells having a declining productivity index. The productivity index will decline as long as the well continues to produce through a choke of a given size. When the well is shut in, the bottom-hole pressure builds up at a slower rate. As the bottom-hole pressure builds up, the initial productivity index will increase, reaching the same initial productivity index as before, when the pressure is the same. Because of this restoration of productivity index, most such wells can be operated intermittently and obtain equal or greater current production with a lower gas-oil ratio than when producing contin-

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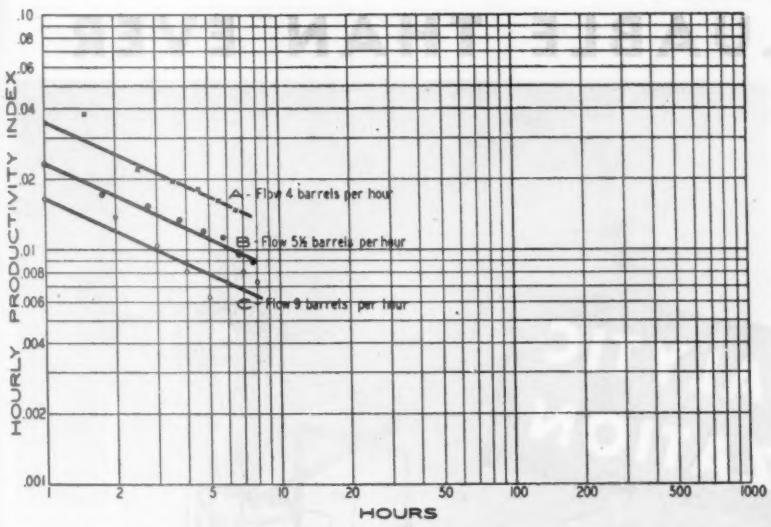

Fig. 3—Ordovician "Wilcox" sand well, showing same rate of productivity index decline at different rates of production, restoration of productivity index during shut-in of well. (Note lower productivity index when well is not shut in long enough to build up static pressure)

uously. The optimum periods of intermitting vary, but in general during the early life the period is a few hours, while later the well may be shut in one or two days each week.

Restoration of productivity index has been responsible occasionally for favorable results attributed to cleaning out, acid treating, shooting, or other work that required a period of shut-in time. Some wells would have had the same increase in production by merely shutting them in for the same length of time.

The magnitude of such relative performance is related to the rate of decline of the productivity index. Wells in some pools have such a high rate of productivity index decline that even on short tests there is enough decline in the production rate to indicate poor recovery. Where the rate of productivity index decline is low, it is difficult to evaluate its influence on the predicted performance. In most pools the wells either do not have a declining productivity index, or the rate of decline is so low that it cannot be measured by a test of reasonable duration and present methods of measurement.

It has been found that the rate of decline of the productivity index is substantially the same, regardless of the rate at which the well is produced.

The procedure in determining declining productivity index is essentially the same as might be used in determining any productivity index. The well is shut in preferably until substantially static conditions are established. It is then produced through a given size of choke, which is not changed during the test, and a gage of oil production is taken each hour, using every precaution to obtain accuracy. Hourly stock-tank production is corrected for changes in amount of oil in the tubing and in the annular space between the tubing and casing. The production for each 2 hours is averaged to determine the rate of production on the hour. To gain accuracy of differential pressure during the first part of the test, the bottom-hole pressure gage is left in the well at the pressure point for a period of at least 10 hours to obtain a continuous pressure record. The rate in barrels per hour each hour is divided by the pressure decline from the static or initial pressure to the end of the hour to ob-

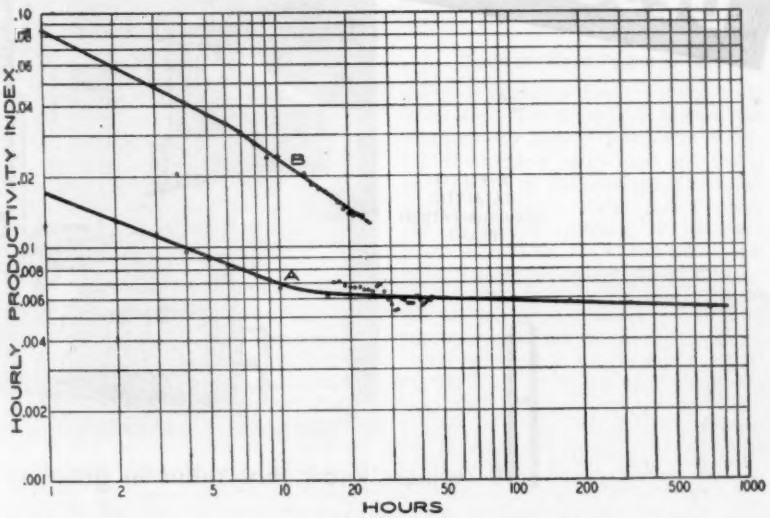

Fig. 4—A change in rate of productivity index decline has been found in a few wells several hours after the test was started

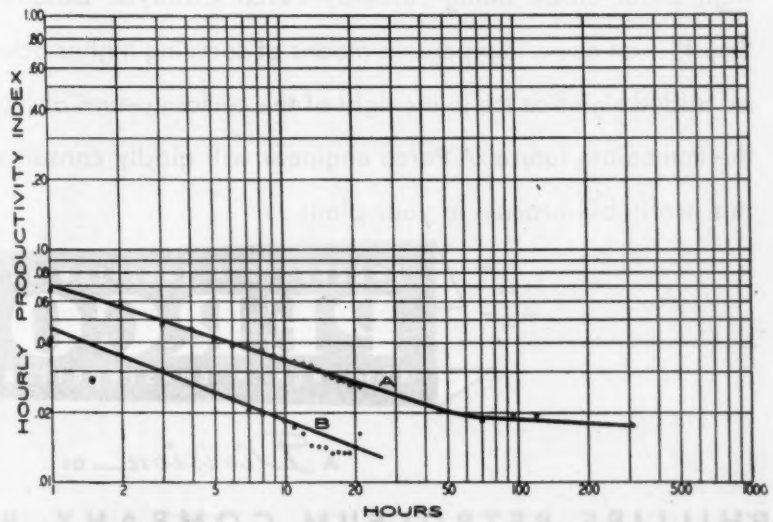

Fig. 5—Curve B is continuation of test shown by curve A after the size of choke has been increased

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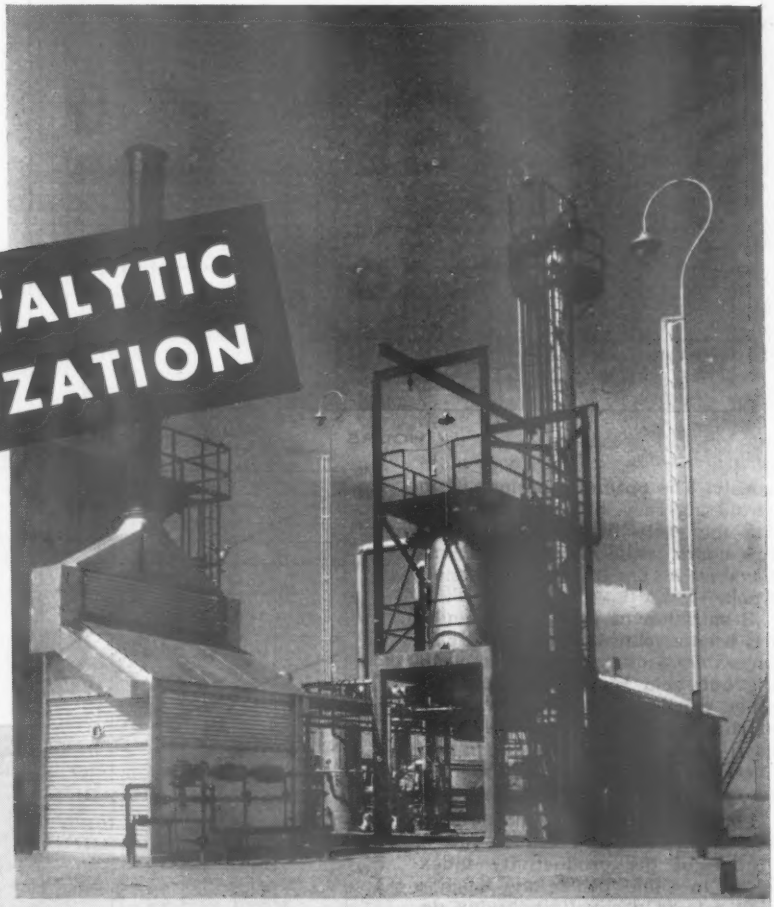

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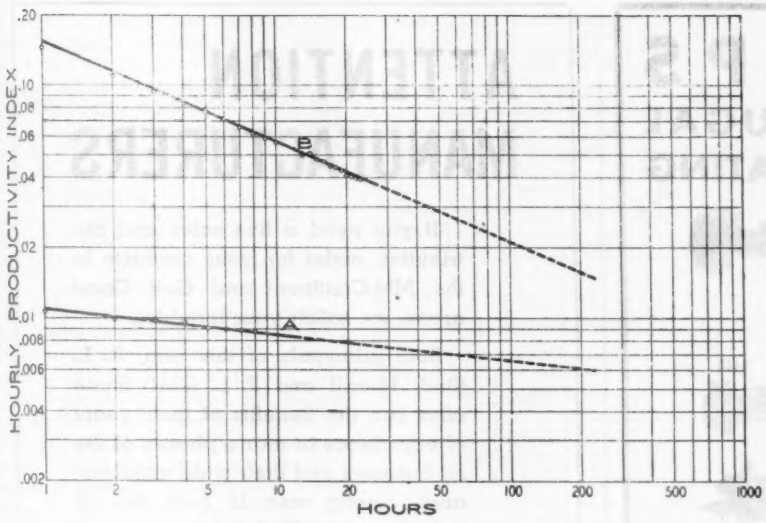

Fig. 6—Curve A shows productivity index decline before acidizing and curve B after acidizing. Note larger productivity index, but higher rate of productivity index decline in curve B, indicating temporary benefit from acid

tain the hourly productivity index. The length of the test may vary, 24 hours usually being sufficient, although frequently a shorter period will give an acceptable test. When a test runs for several days, it may be satisfactory to lengthen the gaging period. After the first 24 or 48 hours, the average hourly production for each 24-hour period is determined, and the bottom-hole pressure is measured at the middle of the period. The hourly productivity index for a number of successive hours having been determined, the data are plotted for analysis on double logarithmic cross-section paper, productivity index on the ordinate and time in hours on the abscissa. The plotted points usually form a straight-line curve.

Declining Productivity

Declining productivity is not characteristic of any one formation or area. Thus far, it has been found more frequently in lime, dolomite, and calcareous sand reservoirs than in true sand reservoirs. It is found in wells in the Gulf Coast, West Texas and Mid-Continent areas, and there is evidence that it is present in other areas. The wells may be small or have very large potentials. Occasionally it is found in a well in a pool in which most of the wells do not have a declining productivity index, but such wells usually are recognized at completion as being poor.

The more general characteristics of wells having a declining productivity index have been discussed and are those which may be reasonably anticipated. The detailed test made to determine declining productivity index often gives other information on the well or the pool, particularly the effectiveness of acidizing, shooting and cleaning out. Several flow tests taken in wells having a declining productivity index are presented to show more clearly the type of information and interpretations that may be made.

Examples

Oil pools in the Miocene sands in the Gulf Coast area, with few exceptions, have an active water drive. Two wells tested had productivity index declines as shown in Fig. 1, and did not have water drive. The wells are in the same pool and the tests were made shortly after completion. During the 30-hour test on well A, the rate of production declined from 10 bbl. per hour to 6 bbl. per hour, and the bottom-hole pressure declined from 2,510 psi. to 1,470 psi. The rate of production from well B was constant at 12½ bbl. per hour during the 27-hour test, but the bottom-hole pressure declined from 3,980 to 3,620 psi. Three years later the static pressure in well A had declined to one-third of the original, and shortly thereafter it was put on artificial lift. Well B after 4 years had static pressure of one-half the original, and was making 7 per cent water. The gas-oil ratio is three times the original, which is less than usual in wells having a similar declining productivity index. Other wells in the same area producing from sands of comparable thickness do not have a declining productivity index and are depleted by natural water flood, with little change in gas-oil ratio and no substantial decline in static bottom-hole pressure.

Tests of West Texas Well

Fig. 2 presents the results of tests on a West Texas well. It shows the productivity index decline at varying production rates, and the usual persistence of the decline. Curve A shows the productivity index while the well was flowing 70 bbl. per hour. Curve B is a 550-hour test with an initial production rate of 52 bbl. per hour and a final rate of 30 bbl. per hour. The divergence of the first few points was caused by reducing the size of the choke about 30 minutes after the well began to produce. Another test of the well is shown by curve C, when it flowed at 11 bbl. per hour for 24 hours without measurable change in the production rate. The curves also show a characteristic of this type

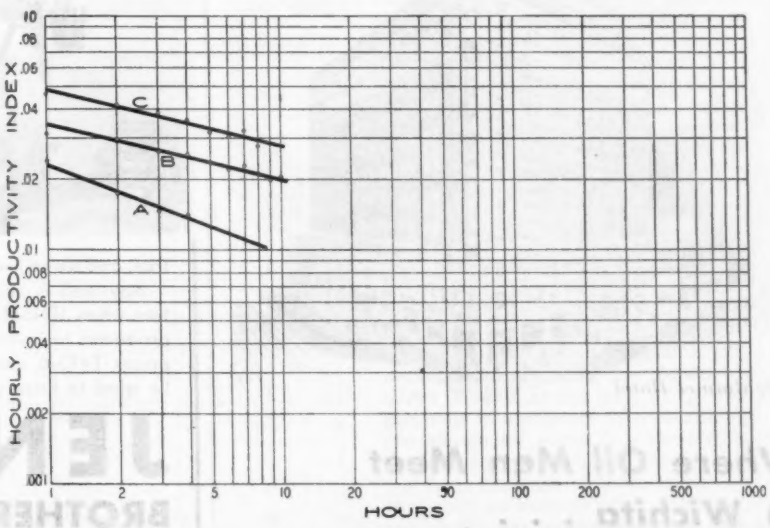

Fig. 7—Curve A before acidizing, curve B after acidizing and curve C, 19 months after acidizing. Larger productivity index and lower rate of decline in curves B and C indicate permanent benefit from acid

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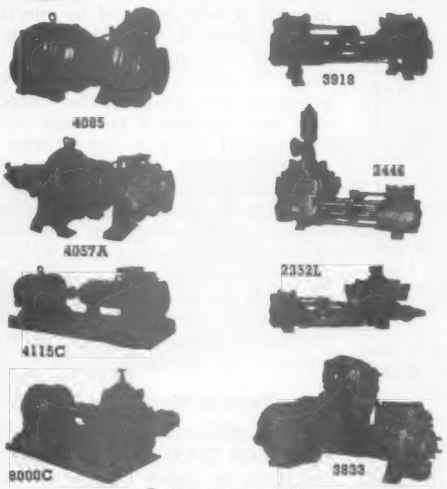

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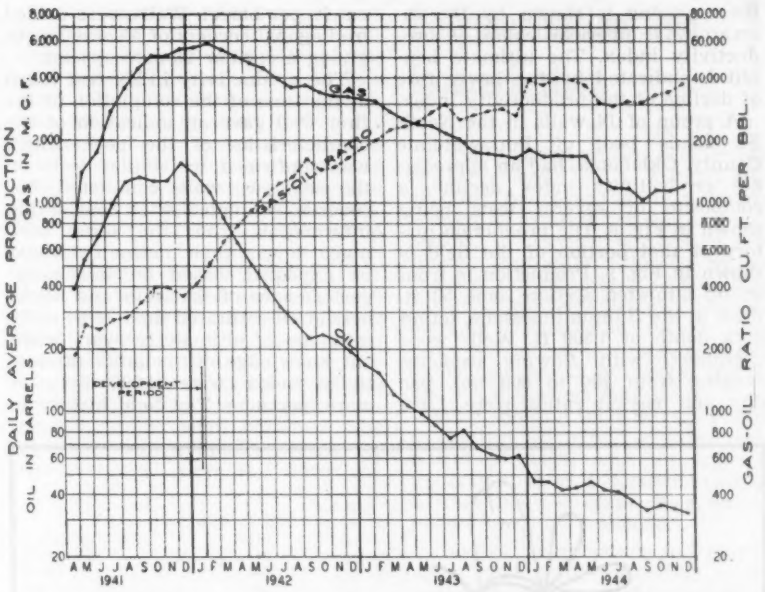
of well to restore its productivity index when it is shut in. It illustrates the characteristic that is important when evaluating benefits of reconditioning that prevents the well from producing for an extended period. If a well has a declining productivity index benefits credited to the reworking of a well may actually be the result of productivity restoration.

Another example of productivity index restoration and consistency of rate of decline is shown by Fig. 3, which shows three tests at different rates of flow on successive days from a Wilcox sand well in Oklahoma. Approximately 16 hours' shut-in time between tests was not long enough to build up to maximum static pressure, and accounts for the initial productivity index being lower on each successive test. Rates of flow during the tests were 4, 5½ and 9 bbl. per hour. The Wilcox is the most widespread and consistent oil-producing sand in Oklahoma, but in this pool it had low permeability although average thickness. The recovery was quite disappointing.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1941
1942
1943
1944

Fig. 3—Production of oil and gas, and gas-oil ratio of 14 wells in the North St. Louis pool, Pottawatomie County, Oklahoma. Rapid decline of oil production and rapid increase of gas-oil ratio were predicted because of declining productivity index found in first wells completed in the pool

Results in New Mexico

The declining productivity index of a well producing in one of the major fields of New Mexico is shown in Fig. 4, curve A. The test illustrates a flattening of the curve that sometimes occurs. On this test the well was produced at an initial rate of 4 bbl. per hour, and after 300 hours had declined to 3⅓ bbl. per hour. The bottom-hole pressure at the beginning of the test was 1,345 psi. and had declined to 950 at the time of the break in the curve; then it declined to 720 psi. at the end of the test. This well was in an area where most wells had a low productivity index decline. Fig. 4, curve B, shows the results of a test in which the rate of productivity index decline increased. In the rare cases observed, this sharp change in slope has been accompanied by increasing gas-oil ratio and greater decline in production and in bottom-hole pressure. When the curve flattens, the apparent transition is a period of a few hours.

The curves in Fig. 5 show the result of changing the size of choke during the test. Curve A shows the decline in productivity index while the well was being produced at 4 bbl. per hour for 310 hours. Curve B is the productivity index curve by continuation of the test after the choke was increased to permit production at the rate of 16 bbl. per hour. It has been observed that a change in choke size to either increase or decrease the rate of flow will cause partial restoration of the productivity index.

The use of productivity index decline tests to evaluate the results of acidizing a well are shown in Fig. 6. The well produced 2½ bbl. per hour through a ¼-in. choke before acidizing. After treatment with acid, a test made through a choke of the same size gave a production of 5¾ bbl. per hour. The productivity index test before acidizing is shown by curve A, which is relatively flat as compared with the test after acidizing shown by curve B. The convergence of these curves indicates that the increase in productivity is temporary and there is a question whether the ultimate recovery was increased.

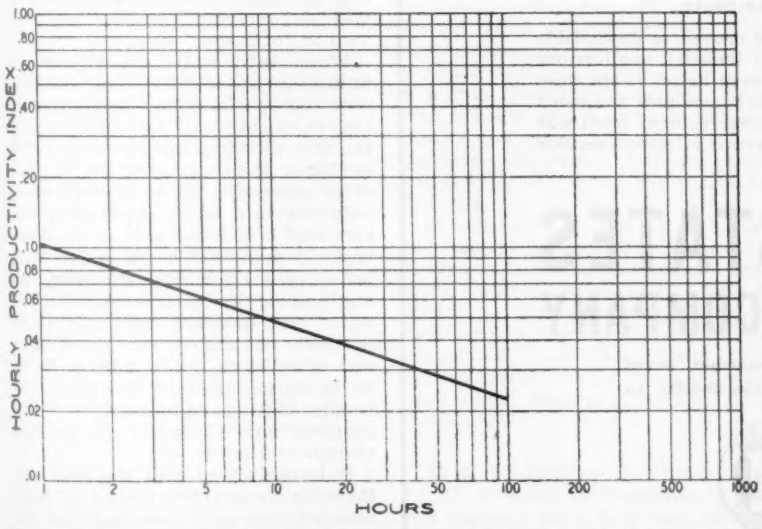


Fig. 8—Composite productivity index decline of several wells in the North St. Louis pool, Pottawatomie County, Oklahoma

Results of Acidizing

A well having beneficial results from acidizing is shown in Fig. 7. Productivity index tests on this well while producing through ⅜-in. choke at the rate of 12½ bbl. per hour before acidizing are shown by curve A, and at the rate of 19 bbl. per hour immediately after acidizing are shown by curve B. Curve C is a test made while producing 11 bbl. per hour through a ¼-in. choke on this well 19 months after acidizing, the additional improvement in productivity index possibly being due to further cleaning out of acid-water residue. The immediate effect of

the acidizing is shown by the increase in numerical value of productivity index. The ultimate benefit is indicated by the lower rate of decline of the productivity index.

A group of 14 wells in the North St. Louis pool of Pottawatomie County, Oklahoma, had an appreciable productivity index decline, a composite of several tests being shown in Fig. 8. The production history of that portion of the field is shown in Fig. 9. Production is from an oil-saturated section some 50 ft. thick in the Hunton limestone, found at a depth of 4,500 ft. Wells were completed with flowing capacity ranging from 200 to 600 bbl. per day and gas-oil ratios were 1,000 cu. ft. per barrel. Wells were drilled in diagonal corners of 40-acre tracts, giving a regular 20-acre spacing.

The productivity index test taken at the time of the completion of the first well gave an indication of the characteristics of the pool, which was confirmed by similar tests on the next two wells completed. Recoveries estimated after considering information from the tests were much lower than normally would be expected, based on the initial performance of the wells and thickness of oil-saturated lime. Most early estimates of ultimate recovery without knowledge of declining productivity index were 4,000 bbl., or more, per acre. The field history to date shows that the ultimate recovery will be approximately 1,900 bbl. per acre.

The high gas-oil ratio in this field is normal for wells with an appreciable productivity index decline. Efforts to improve the ratio were either without effect or had only temporary response. Shooting, acidizing, and selective zone production were of no benefit. Stop-cocking or intermittently producing wells has reduced the gas-oil ratio, but has been less effective than in many pools having a similar declining productivity index.

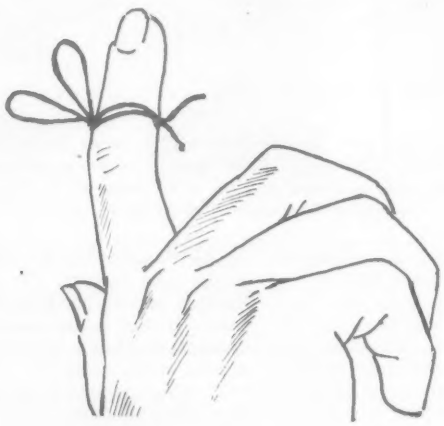
Rapid decline in rate of oil production, increasing and excessive gas-oil ratios, and production without water drive were anticipated early in the life of the field. These predictions based on the declining productivity index were of practical value in the selection of equipment and planning operations for the field. A small electric generating plant, small pumping units driven by electric motors, and automatic time-pumping equipment were selected, all of a type that could be operated intermittently, and so arranged that a minimum of operating labor would be required. Considerable second-hand material, such as tubing and sucker rods, was used for the light pumping service predicted.

Summary

A summary of the experience thus far is that when a test of a few hours duration shows a definite declining productivity index, it is reasonably safe to predict that: (1) the rate of oil production will decline more rapidly than normally would be expected, (2) the gas-oil ratio usually will increase abnormally, (3) the amount of water ultimately produced will be negligible, if any, (4) productivity index will be restored by shutting the well in for a short time.

When such well performance is indicated, it follows that certain reservoir performance and operating practices may be anticipated: (1) the ultimate oil recovery will be lower than expected for a gas-drive reservoir, (2) wells will flow naturally to a lower reservoir pressure and to a lower rate of production, (3) there will be no active water drive, (4) acidizing, shooting, reworking can be better evaluated, (5) wells will produce currently and probably ultimately as much oil, and often more, when shut in from 10 to 30 per cent of the time, (6) smaller lifting equipment will be required and, (7) wells can be operated alternately.

It is significant that the basis of these important predictions is bottom-hole pressure tests that can be made immediately after completion of the wells.



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Salt-Water Injection in East Hackberry Field

(Continued from page 102)

a 7-in. 0.010-gage wire-wrapped screen was set opposite the salt-water sand at 1,533 to 1,575 ft. The well was gas lifted for several days to make certain that it had sufficient capacity for the injection system. It was then equipped with a Layne & Bowler 40-stage turbine deep-well pump set at 300 ft. and powered by a Model HP 351 Buda closed-type six-cylinder gas engine.

The arrangement of the surface equipment of the injection system is shown in Fig. 6. The salt water is pumped from the well directly into a National 10 by 15-ft. pressure filter. From there it flows into a National 10-ft. by 7-ft. 6-in. Vertical accumulator tank. The system is closed throughout and approximately 10 lb. natural gas pressure is maintained above the salt water in these vessels at all times in order to prevent air from getting into the salt water with the possible bad effects of accelerating corrosion and causing precipitates to form.

The accumulator tank is connected to the suction of the injection pump and from there the salt water passes directly to the injection well. A gas-engine-driven centrifugal oil pump capable of putting up around 400 lb. pressure is being used temporarily pending delivery of a Goulds 8-stage all-bronze centrifugal pump powered by a Le Roi Model R-X-I 4-cylinder gas engine. The latter pump will be capable of 500 lb. pressure.

The salt water is measured by a positive-type meter so that there is a constant check on the quantities injected.

Operation Data on Salt-Water Injection

Samples of salt waters from the oil-producing reservoir and the supply well were analyzed before starting injection operations. No objectionable precipitates were caused by the commingling of the two waters.

Salt-water injection was commenced on February 15, 1945. From that time to March 20, 1945, the maximum rate obtained was 40 to 45 bbl. per hour with 250 to 350 lb. pressure. During this period, the well was frequently backwashed in unsuccessful attempts to increase the injection capacity. The daily allowable for the 10 wells producing from this reservoir is 2,050 bbl. of stock tank oil or approximately 2,500 bbl. of reservoir oil. Consequently our injection goal was somewhat in excess of this amount in order to increase the reservoir pressure to a point where the wells would be capable of flowing a considerable amount of water without need of artificial lift. On March 25 the well was acidized with 1,000 gal. of mud acid and 1,000 gal. of wash acid. Immediately after acidizing, the well was placed on gas lift to remove the spent acid and any loosened mud and sand. However the acid treatment and backwashing failed to improve the injection performance. The net total water injected in the well from the beginning to March 29 was 23,611 bbl. On that day the well was acidized again with 1,000 gal. of mud acid and 1,000 gal. of wash acid. This time instead of backwashing, salt-water injection was started immediately after injecting the acid and greatly improved results were obtained. The quantities injected and pressures for the next week were as follows:

	Bbl. of S.W.	Lb. pressure
March 30	3,010	215
March 31	3,440	215
April 1	3,286	215
April 2	3,294	210
April 3	2,957	175
April 4	3,462	175
April 5	3,660	150

The injection rate as shown in Fig. 5 gradually increased to a maximum of 4,350 bbl. on April 13 and then it leveled off at around 3,900 bbl. On May 27 it became necessary to stop injecting water while changing some pipe connections and apparently air or gas got into the system and temporarily reduced the capacity of the well because it took only 1,680 bbl. of salt water the next day under 210 lb. pressure. However, following that, the capacity steadily increased to around 3,500 bbl. per day at 160 lb. pressure and seems to have leveled off at that rate.

Reservoir Pressure Performance

The original reservoir pressure, as previously mentioned, was 5,255 lb. In March 1945 when salt-water injection at a satisfactory rate was first commenced, the pressure had declined to 2,707 lb. The oil production from that time to July 31, 1945, was 272,419 bbl. A total of 436,694 bbl. of salt water was injected during this same period resulting in an increase of 60 lb. in the reservoir pressure.

In conclusion, it can be said that the project is operating in an entirely satisfactorily manner and, with water flooding and complete control of the reservoir pressure, a considerably higher ultimate recovery should be realized along with efficient depletion of the producing sand under simulated natural flow conditions.

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Polymerization and Isomerization

(Continued from page 107)

A combination process is described (3-173) wherein $AlCl_3$ without HCl or other hydrogen halide promoter is used as catalyst for a mixture of olefins, to polymerize tertiary olefins to form lubricating-oil hydrocarbons. Hydrochloric acid is then added to the catalyst and any remaining olefins—other than tertiary—are polymerized to form additional heavy, viscous polymers. Olefins and alkyl phenols may be polymerized by treating their mixtures with a catalyst composed of the compound of $AlCl_3$ with an addition material such as diisobutene (3-174). In this case the alkyl chain on the phenol must be branched.

Another combination for Friedel and Crafts syntheses (3-181) is zirconium or aluminum chlorides which may be used to polymerize tertiary olefins such as i-butene to form heavy lubricating-oil hydrocarbons, at 153° F. It appears that under these conditions tertiary olefins show special aptitude toward formation of heavy polymers.

Another complicated catalyst is described (3-180) as composed of 3,000 g. of sulfuric acid, 500 g. of H_3BO_3, 500 g. of alumina, and 500 g. of an inert support, employed to polymerize olefins at 50-500 psi. and 200°-350° F.

In addition to the catalysts mentioned above, a number of more or less "unconventional" types are mentioned in the literature. Boron trifluoride (3-176) is introduced into a polymerization zone in 1:1 ratio to the olefin present, reacting at 300 psi. and —20° F. to +75° F. Foreign researchers claim that phenol, cresol, or formaldehyde (3-186) are effective as polymerization catalysts on isobutene and other tertiary or secondary olefins.

Isomerization

Isomerization of paraffins, of olefins, cycloparaffins, or aromatics as well may be used in two ways to produce more useful materials on a commercial scale. (1) Normal paraffins may be isomerized to more branched-chain structure to improve octane rating and volatility; (2) Intermediate or raw stocks may be isomerized to prepare charge stock for other operations such as alkylation. An example of the first is the treatment of low-octane-number naphthas with an isomerizing catalyst to raise the octane number. For the second the most widely used process is that of treating butane-pentane, one or both, with a catalyst such as $AlCl_3$ to form isoparaffins containing tertiary carbons, the

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product to be used as one of the intermediates in alkylation to form high-octane-number blending stocks for motor or aviation fuels.

The catalyst par excellence, commercially at present, is aluminum chloride, the catalyst until recently used exclusively, so far as we know, in war plants for the preparation of isobutane and isopentanes for alkylation to make alkylate for aviation blending stock. In a recent article aluminum bromide, Al_2Br_6, is recommended, plus small increments of hydrobromic acid, HBr. In the absence of water the isomerization reaction goes very slowly if at all; small amounts of H_2O are added after which the reaction goes smoothly, the authors state (4-187). Therefore it is neither necessary nor desirable to dry the charge completely if best results are to be obtained. This is in contrast to alkylation with HF in which the charge stock must be carefully dehydrated if catalyst efficiency is to be maintained. (See Article 2, this series, on Alkylation). Heinemann (4-189) isomerizes and alkylates hydrocarbons by treating with a catalyst made up of "a Friedel and Crafts metal halide," some water and an oxygen-containing antimony compound made by hydrolyzing antimony chloride, for example, in water, or by other means; all these components are supported on a solid carrier. Montgomery (4-190) isomerizes butanes by the use of 0.5 to 10 mol per cent of $AlCl_3$ (anhydrous), used at 30°-40° F. and under 60 psig. Cheney (4-191) employs anhydrous $AlCl_3$ along with a small amount of alkali chloride as NaCl or KCl, with 0.3 per cent of a Group 5 metal halide such as $SbCl_3$ or $BiCl_3$. Aluminum chloride catalysts are recovered from isomerization sludges, according to Evering and D'Ouville (4-192), by treating with hydrogen and HCl or other halogen acid, at elevated temperatures and pressures such as 200°-500° F. and 40-400 atmospheres. A supported alumina catalyst may be made (4-193) by precipitating aluminum hydroxide, $Al(OH)_3$, from sodium aluminate solution, partially drying the mass at 200°F, soaking it in an excess of molten $AlCl_3$ under pressure, draining off the excess chloride in an atmosphere of $AlCl_3$ vapors, and then cooling to a temperature below 190° F.

To further activate a Friedel and Crafts catalyst (anhydrous aluminum halide) Laughlin (4-195) adds 0.5 to 10 per cent of CO_2 based on the amount of hydrocarbon present, and carries out the reaction at 150°-250° F. Pines and Block use $AlCl_3$ plus HCl as promoter, remove the HCl from the reaction products by adsorption on "a medium," then desorb the acid for reuse. Naphthas are isomerized to raise the octane

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number several units by treating the low-grade fraction with a catalyst complex of $AlCl_3$ combined with hydrocarbons (4-197). The naphtha is passed through an extended reaction zone or tube at 100°-450° F. and pressure elevated enough to maintain the naphtha in liquid phase. The catalyst complex is made by heating the $AlCl_3$ along with a naphtha fraction which is high in "a saturated, double side chain hydrocarbon of six carbons or more," at 50°-175° F. Apparently somewhat the same result is attained by heating $AlCl_3$ in the presence of one hydrocarbon until the cracking stage is approached (4-198), then heating this complex with another hydrocarbon or hydrocarbons such as one or more having a greater number of carbon atoms than the first one used.

Numerous types of supports are used in preparation of metal halide catalysts. Pumice or diatomaceous earth—as kieselguhr—is saturated with anhydrous $AlCl_3$, and the combination used as an isomerization catalyst (4-199). In another instance an adsorptive carrier, such as activated alumina, is coated with a thin film, 8-28 per cent, of $AlCl_3$, by adsorption of the chloride vapors on the carrier's surface (4-200), while both the body of chloride and the carrier are held at a temperature above the vaporizing temperature of the chloride (about 361° F.) Another method used by the same inventor (4-201) fuses $AlCl_3$ and activated alumina at 190° C. (374° F.) and 40 psig. The mass is cooled and broken into irregular pieces for use as catalyst.

Intimate contact between hydrocarbons and catalyst is attained by vaporizing $AlCl_3$ together with the hydrocarbons to be isomerized, condensing the $AlCl_3$ in presence of the hydrocarbon vapors. Addition of olefin to the mixture produces an alkylation reaction as the second part of the process (4-202). A supported isomerization catalyst is one in which Al_2O_3 is impregnated with $AlCl_3$ as has been described; a bed of unimpregnated Al_2O_3, or one from which the chloride has been removed is also present in the system (4-203). A portion of the bed is removed periodically, reimpregnated, and returned to the reaction zone.

A combination of catalytic cracking, of the well-known McAfee $AlCl_3$ variety, with isomerization of the initial products is proposed by Egloff and Komarewski (4-207). A charge stock of gas oil with varying proportions of $AlCl_3$ (wherever herein $AlCl_3$ is mentioned, the anhydrous form is meant unless stated otherwise in each case) is heated to the cracking temperature (700° F. or higher) in a reaction zone. A mixture of molecular hydrogen and anhydrous HCl is heated to a temperature above that of the cracking operation, and the mixture is added to the reaction zone to promote the isomeration of the cracked product. Since $AlCl_3$-cracked naphtha is of low-to-medium octane rating, such a process, if effective should remove one of the disadvantages inherent in aluminum chloride cracking, that of low octane number; such cracked gasoline is extremely free of impurities, of gum-forming, and similarly undesirable byproducts.

Numerous combinations of $AlCl_3$ are found, with other materials. Ipatieff and Pines (4-208) use a catalyst of hydrogen halide, as HCl, with a mixture of $AlCl_3$ plus $ZnCl_2$, supported on crushed brick, charcoal, etc., at 50°-350° F., and pressures from 1 to 200 atmospheres (15-3,000 psi.) An interesting variant of this idea if that of Ross and Anderson (4-210) in which aluminum chloride, sulfur dioxide, and zinc chloride are employed in the ratio 4:2:1. Generally speaking the effectiveness of $AlCl_3$ as a catalyst is injured by the presence of water in any form, one recommendation for catalyzing isomerization reactions (4-213) is $AlCl_3$ in the ratio of 1 to 1.5 times the weight of the hydrocarbons present in the reaction zone at a given time, with 1-20 per cent HCl, based on the aluminum chloride used and with 0.1 to 2 per cent water present in the reaction zone.

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Use of $AlCl_3$ with varying pressures and with HCl as promoter is instanced (4-215) by combining the two, catalyst and promoter, at 210°-220° F. and at 150-215 psig., and later raising the pressure to 275 psig. Many other cases of the use of $AlCl_3$ with other components are of record, $AlCl_3$ in 75-150 per cent, SO_2 in 0.5 to 10 per cent by weight (4-216) is recommended. Ferric chloride anhydrous, itself a fairly strong Friedel and Crafts catalyst, is used as a promoter (4-127) with $AlCl_3$, in 1.75 to 20 per cent concentration, at 50°-200° F. A double salt of $AlCl_3$ and alkali, as NaCl, is used effectively in one method (4-218), at 150°-225° F. for butane isomerization, 30°-150° F. for pentane, and 1.1 to 2.5 mols of $AlCl_3$ per mol of alkali chloride. An in situ catalyst is made by treating, presumably within the reaction zone, Al, Zn, or Fe metal with HCl (4-227). Salts of mercury, copper, cadmium, nickel or iron are added to $AlCl_3$ in the presence of Al, Mg, or Zn metal (4.220). Alumina impregnated with $AlCl_3$ is employed in a series of zones with increasing temperature with 210°-230° F. as the top temperature (4-229). Mixed halide salts of aluminum, such as $AlCl_2F$ (4-230) plus anhydrous HCl as promoter are claimed to show improved efficiency as catalysts.

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Sulfuric acid, or halogenated sulfonic acids (4-242) as HSO_3Cl, with free H_2 and boron trihalide, is claimed successful in isomerization. Phosphoric acid on kieselguhr (4-188) shows an isomerization catalyst life of 400 hours at 300° C (572° F.) with 20 per cent water to isomerize n-butylene to i-butylene. Copper oxide mixed with a copper salt made by treating CuO with concentrated sulfuric or phosphoric acid (4-194) is used to catalyze the change of 1-olefins to 2-olefins. HF-treated clay which is treated previously with H_2SO_4 or HCl and containing Co, Fe or Ni metal is used in presence of free H_2 at 550°-750° F. and 100-300 psig. (4-206) for 8-12 hours to isomerize hydrocarbons.

A unique catalyst for isomerization is bauxite (4-214) impregnated with 10-60 per cent concentrated sulfuric or phosphoric acids, for isomerizing olefins. Again, 70 per cent sulfuric acid is used (4-219) at 170° F. to isomerize olefins. Aliphatic ethers may be used as catalyst activators with salts such as $AlCl_3$. An unusual catalyst is the recommendation of brucite (4-231), which has been activated at 1,000° F. Sulfur trioxide and HF or boron trifluoride (4-233) with or without HF in molal excess of the SO_3 is used to isomerize butanes.

Other materials as well are recommended by patent or technical literature as isomerization catalysts. Of these proposed catalysts the only one in wide commercial usage in the petroleum industry so far as we know is aluminum chloride in its various forms.

This catalyst and the process employing it has been developed to commercial scale largely by Universal Oil Products Co. scientists and engineers, which company has contributed largely to the development of a great number of processes.

Bibliography

Reference. Journal, or date of patent issue. Nature of catalyst. Polymerization catalysts.

3-162b. Synthetic Lub. Oil Fractions—Rec. Trav., Chim. vol. 63, p. 105 (1944). $AlCl_3$-Ni, $AlCl_3$-Cu.

3-163. U. S. 2,288,873. July 7, 1942. Furnace slag-HCl or H_3PO_4.

3-164. U. S. 2,288,872. July 7, 1942. Ppted. silica-metal gel.

3-165. U. S. 2,295,125. Sept. 8, 1942. Phosphoric Acid to remove catalyst poisons.

3-166. U. S. 2,300,123. Oct. 27, 1942. Zn-pyrophosphate—H_3PO_4.

3-167. U. S. 2,301,052. Nov. 3, 1942. Activated bentonite, or Al_2O_3-SiO_2.

3-168. U. S. 2,303,547. Dec. 1, 1942. Cracking polymerizing catalyst.

3-169. U. S. 2,304,083. Dec. 8, 1942. Cobalt pyrophosphate.

3-170. U. S. 2,307,689. Jan. 5, 1943. Cu-NH_4-pyrophospate-charcoal.

3-171. U. S. 2,310,161. Feb. 2, 1943. Metal pyrophosphates on carrier.

3-172. U. S. 2,316,380. April 13, 1943. H_2SO_4 plus 2 per cent $AgSO_4$.

3-173. U. S. 2,320,256. May 25, 1943. $AlCl_3$ plus H halide.

3-174. U. S. 2,327,938. Aug. 25, 1943. $AlCl_3$-hydrocarbon complex.

3-175. U. S. 2,336,793. Dec. 14, 1943. Metal

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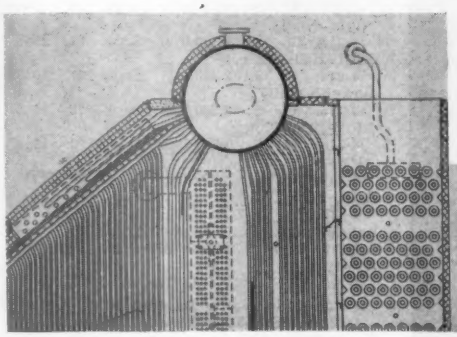

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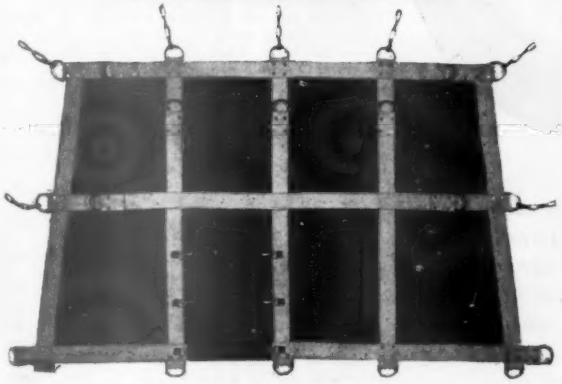

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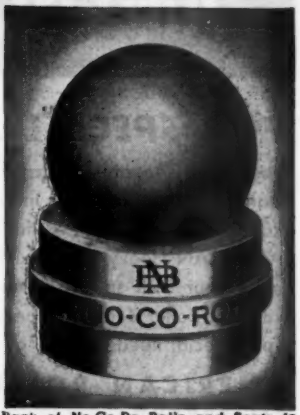

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pyrophosphates plus activated carbon.

3-176. U. S. 2,345,574. April 4, 1944. Boron trifluoride.

3-177. U. S. 2,348,836. May 16, 1944. H_3PO_4 on quartz, pumice, etc.

3-178. U. S. 2,349,160. May 16, 1944. SiO_2 plus 0.5-2 per cent Al_2O_3.

3-179. U. S. 2,354,261. July 25, 1944. H_3PO_4 on 50-400 mesh kieselguhr.

3-180. U. S. 2,355,868. Aug. 15, 1944. 6 H_2SO_4, 1 H_2BO_3, 1 Al_2O_3, 1 support.

3-181. U. S. 2,355,925. Aug. 15, 1944. Zirconium chloride or $AlCl_3$.

3-182. Br. P. 546,037. June 24, 1942. H_3PO_4, Cu & Ca phosphates.

3-183. Br. P. 552,413. April 7, 1943. Hydrous silica & alumina.

3-184. Can. P. 411,666. April 6, 1943. SiO_2, Al_2O_3, Group II metal oxides.

3-185. Ger. P. 713,230. Oct. 9, 1941. H_3PO_4 and finely divided Cu metal.

3-186. Ger. P. 704,038, 738,425, 738,426. July 15, 1943. Phenol, cresol, or formaldehyde, for isoolefins.

Isomerization Catalyst References

4-187. Catalytic Isomerization of Butane, J. Am. Chem. Soc., vol. 65, p. 2276 (1943). •$AlBr_3$ plus HBr to give $HAlBr_4$.

4-188. Isomerization of n-Butenes to i-Butenes, Neftyanoya Prom., 1941, No. 1, p. 93. HP_3O_4 plus kieselguhr.

4-189. U. S. 2,287,244. June 23, 1942. Metal halide, water, antimony hydroxide.

4-190. U. S. 2,288,477. June 30, 1942. Al halide.

4-191. U. S. 2,291,376. July 28, 1942. $AlCl_3$, alkali halide, as NaCl.

4-192. U. S. 2,293,891. Aug. 25, 42. Recover $AlCl_3$-HC sludge catalyst.

4-193. U. S. 2,295,977. Sept. 15, 1942. $AlCl_3$ on partially dehydrated $Al(OH)_3$.

4-194. U. S. 2,298,931. Oct. 13, 1942. CuO-$CuSO_4$, or $Cu_3(PO_4)_2$.

4-195. U. S. 2,300,160. Oct. 27, 1942. Metal halide plus CO_2 as activator.

4-196. U. S. 2,300,235. Oct. 27, 1942. $AlCl_3$ plus HCl.

4-197. U. S. 2,300,249. Oct. 27, 1942. $AlCl_3$-Hydrocarbon complex plus HCl.

4-198. U. S. 2,307,053. 1942. $AlCl_3$ plus HCl.

4-199. U. S. 2,311,232. Feb. 16, 1943. $AlCl_3$ + HCl on pumice, earth.

4-200. U. S. 2,311,712, 2,311,713. Feb. 23, 1943. $AlCl_3$ on alumina.

4-201. U. S. 2,313,053. March 9, 1943. Fused $AlCl_3$-alumina.

4-202. U. S. 2,316,775. April 20, 1943. Anhydrous $AlCl_3$.

4-203. U. S. 2,323,830. 1943. $AlCl_3$-Al_2O_3.

4-204. U. S. 2,324,295. July 13, 1943. $AlCl_3$-HCl, SO_2 extraction of olefins.

4-205. U. S. 2,324,746. 1943. $AlCl_3$ in solid-supported beds.

4-206. U. S. 2,324,762. 1943. HF-treated clay.

4-207. U. S. 2,326,627. Aug. 10, 1943. $AlCl_3$-cracking and isomerization.

4-208. U. S. 2,327,188. 1943. $AlCl_3$-Zr_2Cl_2-HCl.

4-209. U. S. 2,327,593. Aug. 24, 1943. $AlCl_3$ on Al_2O_3.

4-210. U. S. 2,327,670. Aug. 24, 1943. $AlCl_3$-$ZnCl_2$-SO_2.

4-211. U. S. 2,328,753 Setp. 7, 1943. Calcined Si-Al and/or Zr oxides.

4-212. U. S. 2,330,071. Sept. 21, 1943. Alunite.

4-213. U. S. 2,330,079. Sept. 21, 1943. $AlCl_3$-HCl-water.

4-214. U. S. 2,330,115. Sept. 21, 1943. Bauxite-H_2SO_4.

4-215. U. S. 2,330,754. Sept. 28, 1943. $AlCl_3$-HCl.

4-216. U. S. 2,330,761. Sept. 28, 1943. $AlCl_3$-SO_2.

4-217. U. S. 2,330,787. Sept. 28, 1943. $AlCl_3$-$FeCl_3$.

4-218. U. S. 2,332,275. Oct. 19, 1943. Al halide, plus alkali halide, as NaCl.

4-219. U. S. 2,334,998. Nov. 23, 1943. 70% H_2SO_4.

4-220. U. S. 2,337,418. Dec. 21, 1943. $AlCl_3$, Cu and other salts, Al and other metals.

4-221. U. S. 2,338,472. Jan. 4, 1944. Anhydrous $AlCl_3$, HCl promoter.

4-222. U. S. 2,338,568. Jan. 4, 1944. $AlCl_3$-aliphatic ethers.

4-223. U. S. 2,339,685. Jan. 18, 1944. Regenerate $AlCl_3$ on Al_2O_3, with steam.

4-224. U. S. 2,341,286. Feb. 8, 1944. $AlCl_3$ or halide, on solid carrier treat with C_4H_{10} and O_2.

4-225. U. S. 2,342,073. Feb. 15, 1944. $AlCl_3$ plus alkali salts, as KCl.

4-226. U. S. 2,342,248. Feb. 22, 1944. 80% Al_2O_3-20% Cr_2O_3.

4-227. U. S. 2,344,466 and 2,344,467. March 14, 1944. $AlCl_3$, formed in situ.

4-228. U. S. 2,344,890. March 21, 1944. Halosulfonic acid, as HSO_4Cl.

4-229. U. S. 2,346,527. April 11, 1944. $AlCl_3$ on Al_2O_3, HCl promoter.

4-230. U. S. 2,351,562. June 13, 1944. Mixed halide metal salt, as $AlCl_2F$.

4-231. U. S. 2,353,552. July 11, 1944. Brucite.

4-232. U. S. 2,353,899. July 18, 1944. Fused $AlCl_3$-$CaCl_2$, HCl promoter.

4-233. U. S. 2,354,565. July 25, 1944. HF, SO_2, BF_3, etc.

4-234. U. S. 2,354,652. Aug. 1, 1944. Al halide and Hydrogen.

4-235. Br. P. 548,901. Oct. 29, 1942. Oxides and sulfides of metals, Groups 6 and 8.

4-236. Br. P. 549,139. Nov. 9, 1942. "Solid Catalyst" for olefins.

4-237. Br. P. 549,233. Nov. 16, 1942. Friedel-Crafts catalyst, formed in situ from H halide and metal.

4-238. Br. P. 550,389. Jan. 6, 1943. Concentrated H_2SO_4.

4-239. Br. P. 550,477. Jan. 11, 1943. Oxides or sulfides of Group 6 metals.

4-240. Br. P. 550,480. Jan. 11, 1943. Oxides or sulfides of Group 6 metals and H_2, H_2S, or CH_3SH.

4-241. Br. P. 551,644. March 4, 1943. Hydrolyzed $AlCl_3$.

4-242. Br. P. 551,961. March 17, 1943. Halogenated sulfonic acid, H_2, Boron trihalide.

4-243. Br. P. 553,976. June 11, 1943. Fused $AlCl_3$-$SbCl_3$ treated with HCl.

4-244. Can. P. 411,524. March 30, 1943. Vaporized $AlCl_3$ sublimed on carrier.

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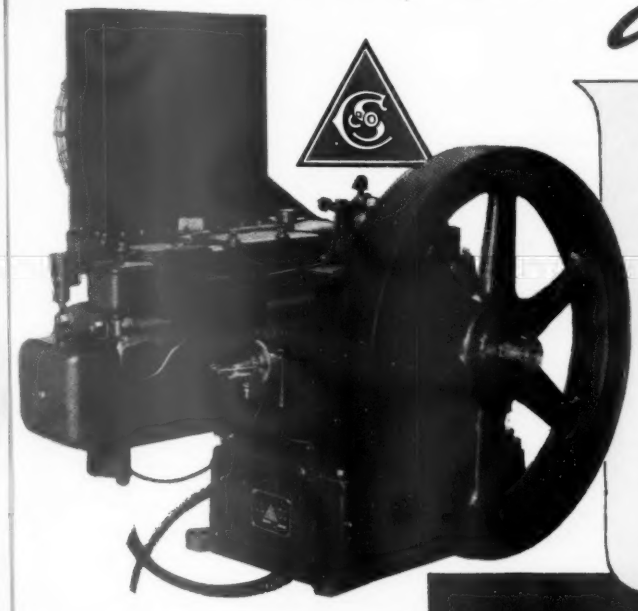

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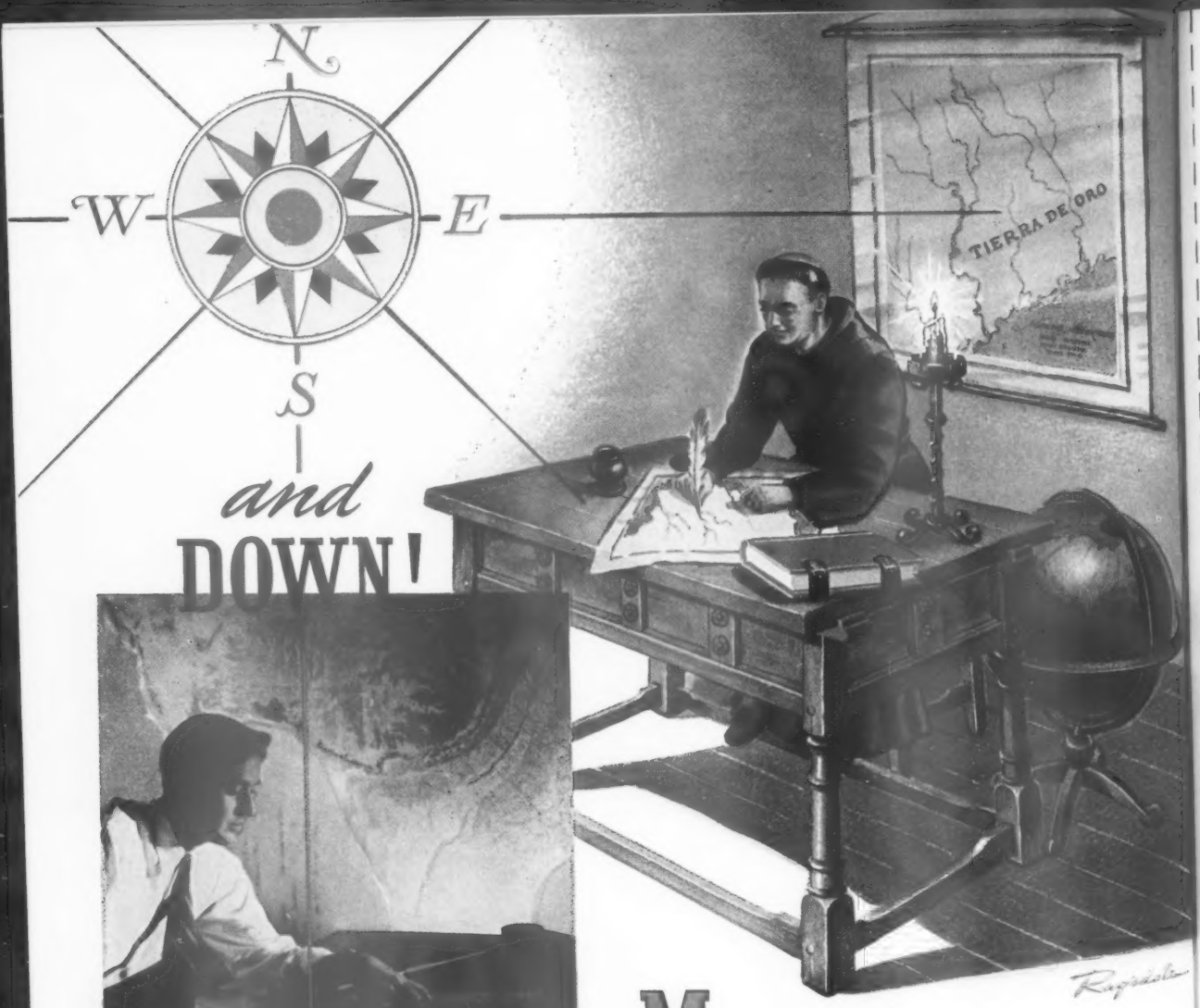

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A WEEKLY FEATURE OF THE OIL AND GAS JOURNAL

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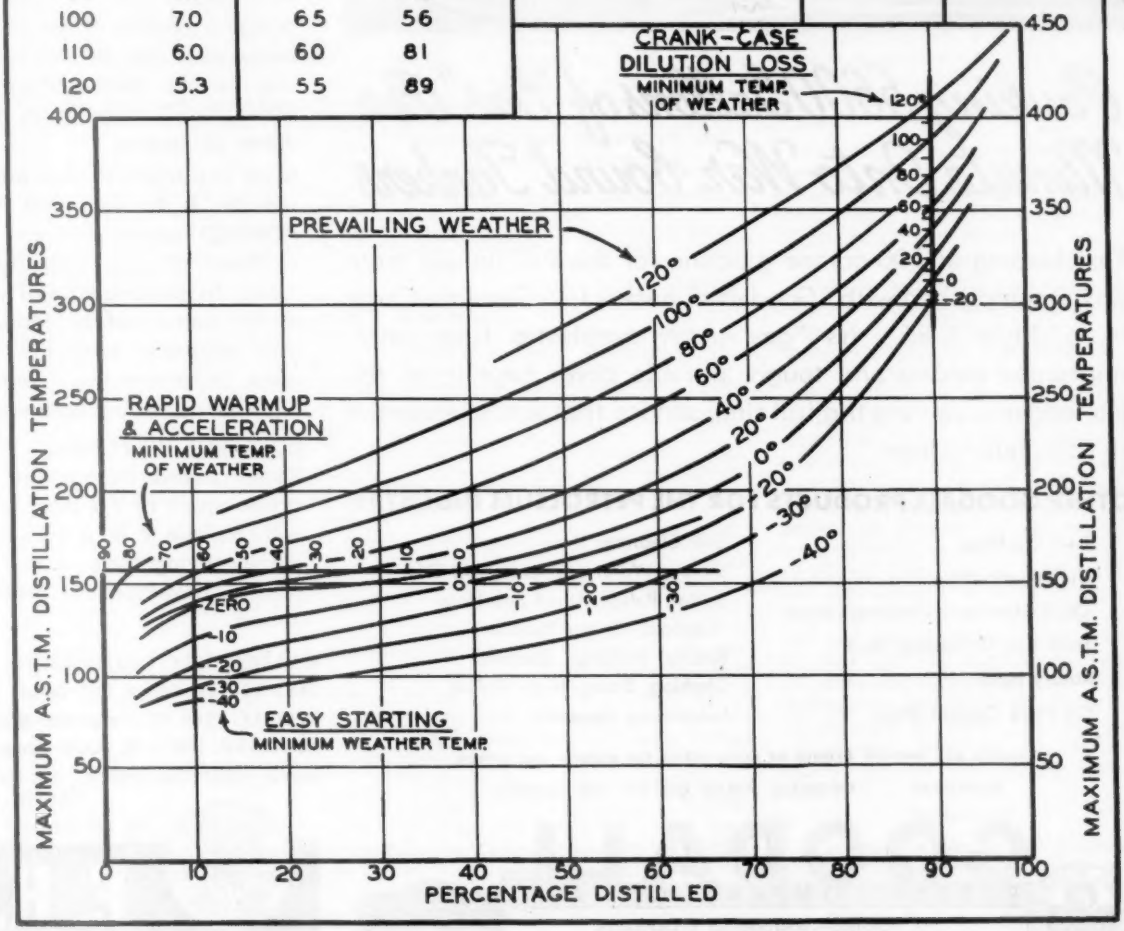
VAPOR LOCK		DETONATION			GUM A.S.T.M.	INDUCTION PERIOD	SULFUR
WEATHER °F	REID V.P. MAX.	A.S.T.M. OCT. NO.	% OF CARS THAT "KNOCK"		MG/100 ML.	HOURS	PER CENT
60	12.7			TROUBLESOME	30-50	1-2	—
70	11.0	80	2	SOMETIMES O.K.	15-25	2-4	.15-.45
80	9.4	75	8	SATISFACTORY	6-10	4-7	.05-.15
90	8.0	70	22				
100	7.0	65	56				
110	6.0	60	81				
120	5.3	55	89				



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A FEATURE OF THE OIL AND GAS JOURNAL

Tracing Flow of Fluids and Gases Beneath Ground

IT is important to trace the extent and rate of movement of fluids beneath the ground in water-flooding operations, in acid-treating operations, and, in some cases, in working out the best methods of preventing water influx into oil wells. Unfortunately, this important line of investigation has not received as much attention from engineers as it deserves. Only a few attempts have been made to trace subsurface fluid, and only a few recent articles have been published on detecting gas migration. The chief methods of tracing underground fluid and gas flow are as follows: (1) Use of dyes in water; (2) use of chemical analyses; (3) use of nitrate in water; (4) use of radioactive substance in oil, gas, or water, and using an electroscope; (5) dissolving lithium salts in water and using mass spectrometer; (6) determining pH of the water; (7) adding ethyl mercaptan gas; (8) adding nitrogen or helium to gas. The technique and application of these various substances to detecting subsurface fluid movement are discussed briefly in this and following articles.

The use of dyes to trace underground water flow has been described by Dole, Rogers, Ambrose, and others. Dole recommended the use of 300 g. of the sodium salt of fluorescein dissolved in 1 gal. of water and continued the addition of dye to the well until ½ to 2 lb. per well were used. Others dissolve 1 to 2 lb. of the fluorescein dye in strong solutions of caustic soda and add 15 to 100 lb. of the dye to the intake well. Dole describes cases in France where the migration of fresh water was traced through a succession of wells by examining samples collected hourly from producing wells. The samples are placed in tubes of pure white glass 95 cm. long, 15 mm. in diameter, and closed at the lower end. The tubes of water are examined with the naked eye or through a fluoroscope, or by means of an ultraviolet lamp. In the case of extreme dilution the lamp method is preferred. Fluorescein is a weak acid, having a yellowish-green fluorescence and a purple color when flowed in an ultraviolet lamp. Its color, which may be seen in extreme dilution, is absorbed by organic matter and destroyed by free acid, by oxidizing agents, and by heat. The author has never been able to use it successfully in oil-field waters and considers its use doubtful. Ambrose,[1] on the other hand, describes its use in the Santa Maria field in California for tracing the flow of water from one well to another, a distance of 300 ft. apart. The U. S. Bureau of Mines reports that in 1907 aniline dye placed in well No. 309 in the Salt Creek, Wyoming, field was later detected from water in well No. 307, a distance of 600 ft. Rogers[2] reports that water containing a dye migrated 900 ft. in about 1 day from well to well near Fellows in the Midway-Sunset field of California.

The following list includes a series of substances, which have been experimented with trying to trace the flow of water:

TRACERS USED TO DETECT THE MIGRATION OF WATER

Substance	Color	Effective dilution
Fluorescein	Yellowish green	1 part in 240,000,000*
Eosin	Red	1 part in 2,000,000
Aniline	Red and green	1 part in 1,000,000
Uranin	Yellow	1 part in 500,000,000†
Methylene blue	Blue	Not reported
Ameranth	Red	Not reported
Potassium dichromate	Yellow	1 part in 4,800
Lithium salts	Colorless	1 part in 10,000
Sodium nitrate	Colorless	1 part in 2,000

*With fluoroscope 1 part in 2,000,000,000. †With fluoroscope.

Fluorescein has been the most used of these dyes and is detectable in the lowest concentrations. It is, however, subject to loss of color in oil-field water. Actual trials in the salt-water-disposal systems of East Texas oil-field using 5 lb. of dye to 5,000 bbl. of water even when using a fluores-violet lamp lost its color almost completely in traveling 400 ft. through the disposal system not treated with chlorine. Eocene, aniline, and methylene blue have the same characteristics as fluorescein, but are less sensitive and less easy to detect. Ameranth dye has been reported to have proved the most successful of a number of dyes in tracing water floods under laboratory conditions at Pennsylvania State College. This dye, which is manufactured by Du Pont, is of very deep red color, readily dissolves in small quantities in water, and persists to extreme dilution, and proved to be a good tracer in the laboratory. As far as known it has not been tried out in the oil fields. The underground-water division of U. S. Geological Survey working with fresh and brakish waters in West Texas found the dye, uranin, the most satisfactory.

Lithium salts as tracers have the advantage that they are, in most cases, not present in underground water and can be detected in extremely small quantities by using a mass spectrograph. But, they have the disadvantage that the mass spectrograph is a rather expensive apparatus, requires a highly trained operator, photographic dark rooms, and other special facilities.

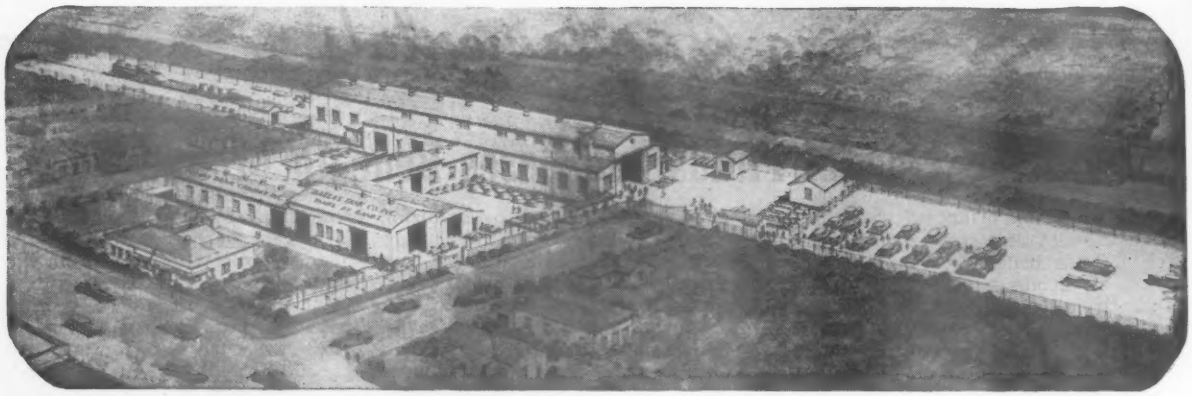
Sodium nitrate has been recommended by water engineers and seems to be adapted best to tracing fresh water. Nitrate can be detected in small concentrations by a simple chemical test as follows:

Pour the water in a long test tube or glass cylinder until it is about half filled. Slant the tube to an angle of about 45° and pour concentrated chemically pure sulfuric acid slowly down the edge of the inclined tube. The acid will flow along the lower side of the tube and collect at the bottom forming a separate layer of acid at the bottom and water at the top. If any nitrate is present in the water, even in small quantities, a brown ring will form at the acid-water contact. Adding a little diphenylamine or diphenylbenzidine to the sulfuric acid gives a blue color by reaction with the nitrate, even in solutions having as low concentrations as 5 parts of nitrate in 10,000 parts of water. The amount of nitrate may be determined quantitative by colorimetric methods.

References

1. Ambrose, A. W., Use of Detectors for Tracing Movement of Underground Waters, U. S. Bur. Mines, Bull. 195, Pet. Tech. 62, pp. 106-120.
2. Dole, R. B., Use of Fluorescence in the Study of Underground Waters, U. S. G. S. Water Supply Paper 160, pp. 73-85.
3. Rogers, G. S., Methods for Tracing the Migration of Waters, U. S. G. S. Prof. Paper 117, pt. 2, pp. 98-99.

Series prepared by F. B. Plummer, professor, petroleum engineering school, University of Texas



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In oilfields where several pumping engines require frequent servicing, Cannon Electric Connectors effect equipment savings, greater safety, faster well servicing and improved maintenance procedure. The plug end of the connector is attached to a battery on the service truck; the receptacle is mounted on the engine frame. Cost is low; installation easy. Write today for further information. Address Dept. A-167, Cannon Electric Development Company, 3209 Humboldt Street, Los Angeles 31, California.

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OIL AND GAS EQUIPMENT Digest

IT'S NEW CHECK IT

by Kenneth B. Barnes

(1) NEW PLASTIC-GLASS PANEL for electrical control boards and other uses is far more fire-resistant than many other pressed-type materials because, when heated, it produces nitrogen, an inert gas that smothers flames. The new form of Micarta is made of glass cloth bound together with a resin binder of the melamine class, a cyana-

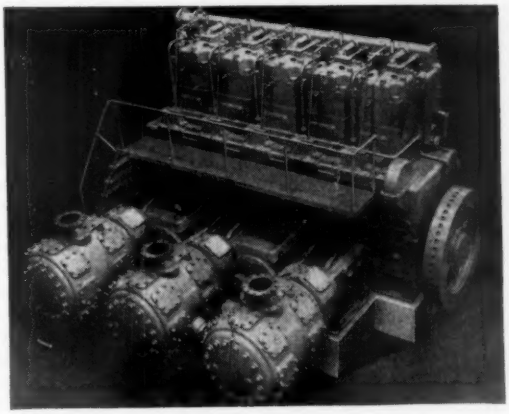
mid-base synthetic. When this binder is used with the glass cloth, an inorganic substance, the two together make a practically fireproof material. The layers of glass cloth, coated with melamine resin, are plied to proper thickness, then pressed and heated for polymerizing the resin around the fibers into the new composite panel material. *Westinghouse Electric Corp.*

IT'S NEW CHECK IT

(2) SAFETY VENTS FOR VAPORS give double protection, in that they are a combination vapor valve and rupture diaphragm. The units contain a special disk or rupture diaphragm that will break to relieve excessive pressures which may build up within a storage tank or pressure vessel. In addition to the rupture diaphragm, these vents have the ordinary function of permitting a safe escape of inflammable gases from the receptacle. This is accomplished by means of a specially designed unit with perforated brass flame barrier plates. Exhaustive tests have shown that this feature prevents flames from flashing back through the perforated vent plates into the tank where inflammable liquids might be ignited. *J. A. Zurn Mfg. Co.*

IT'S NEW CHECK IT

(3) "BIG ANGLE" COMPRESSOR UNITS have ratings of 1,000, 1,200 and 1,600 hp. With a 17-in. bore and 17-in. stroke, the compressors are developed in 5, 6, and 8-cylinder models. Simplicity of appearance and operation is reflected on both exterior and interior. The power cylinders are nearly square and are set close together. Immediately below comes the camshaft housing consisting of a series of removable plates. These, when removed, immediately expose the camshaft and cam followers for easy maintenance inspection. The camshaft is operated by a chain drive from the crank shaft. The magneto or distributor, the governor, and the lubricator are driven by a separate chain drive. Both drives are located at the flywheel end of the engine. The scavenging air manifold is cast into the upper crank case. Power pistons are of three-piece construction. The piston head and ring carrier are of steel to reduce ring-



The Oil and Gas Equipment Digest presents a review of what is new in equipment and trade literature . . . makes it possible for readers to obtain full information on every subject by use of convenient "Check It—Mail It" service card. This periodic feature of The Oil and Gas Journal will include all that is new in equipment . . . at a time when new products are being introduced, and existing products improved.

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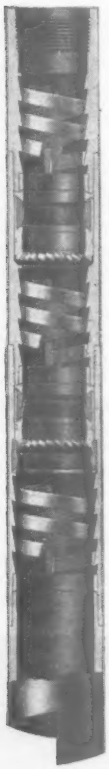
XUM

groove wear and to allow the well-finned head to be of minimum thickness for best heat transfer to the oil-cooled interior. The piston skirt is a symmetrical cylinder having no openings or bosses to permit uneven expansion. The piston fin is held in a carrier which forms the third part. Efficient cooling throughout is maintained by the improved high-velocity water jacketing of the dry joint cylinder heads and the exhaust manifold. *Clark Bros. Co., Inc.*



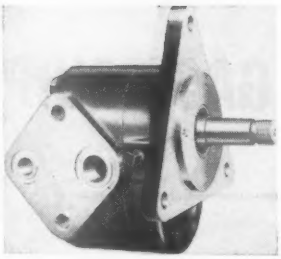
IT'S NEW CHECK IT

(4) NEW SERIES 350 OVERSHOT for external upset drill pipe provides a tool that will catch and pack off pipe, pipe upset or tool joint without making any changes or adjustments. It is a three-bowl assembly, incorporating grapples and pack-off rubbers for the three sizes, milling members for rounding up the jagged ends of pipe or upset, and a guide for centering the fish in the tool. An important feature is that it both sets and releases on right-hand rotation, thus avoiding the dangers of turning the string in an unscrewing direction. Right-hand rotation of the string expands the grapple as the tool is simultaneously lowered over the fish, and simply allowing rotation to stop causes the grapple to take hold around the fish. Thereafter when upward pull is exerted the hold is secure, since hold is taken as soon as it is over the fish. Available in complete range of sizes and fittings. *S. R. Bowen Co.*

IT'S NEW CHECK IT

(5) LEAKS IN CONCRETE? FORMULA 640 stops transmission of water through any absorbent material, also protects surfaces from acids and alkalis. Composed of seven different compounds dissolved in a hydrocarbon base, No. 640 is drawn into the voids by capillary attraction. Penetrates wherever water will penetrate, becomes an integral part of the material. Not necessary to apply it to pressure side. Practically all stone used in building construction is porous. In concrete the voids range from 13 to about 17 per cent, while mortar contains minimum of 28 per cent. No. 640 prevents water coming through outside walls and consequent damage from freezing, cracking, spalling. Request will bring free sample. Other products include cement hardener to make cement surfaces flint-like, paint to withstand 2,000° F., paint for preventing condensation on cold water pipes; a mastic resurf for leveling worn concrete and wood floors. *Haynes Products Co.*

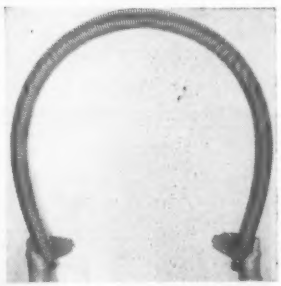
IT'S NEW CHECK IT



(6) NEW HYDRAULIC PUMP features unusually high volumetric efficiency. Thorough calibrations show volumetric efficiencies of 95 per cent and better at 3,000 r.p.m. under pressure of 1,500 psi. The gear-type pump incorporates the "pressure-loading" principle of the Pesco aircraft pumps, is suitable for universal application where hydraulic power is utilized. Weight is only 4.4 lb. *Pesco Products Co.*

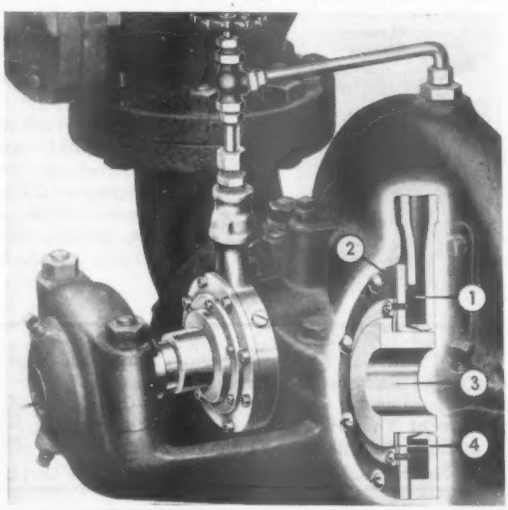
IT'S NEW CHECK IT

(7) FLEXIBLE STAINLESS HOSE is being produced for applications where flexible connections are required between movable parts, or where vibrations are set up between two rigidly held units. The hose can also be used for flexible steam connections, flexible conduits for wiring, intricate connections on lines carrying corrosive fluids, etc. *Carpenter Steel Co.*



IT'S NEW CHECK IT

(8) JET SHAFT SEAL has been developed for pump installations to eliminate waste of fluid, packing expense, and the causes of sleeve and shaft wear. The seal draws pressure from the high point and directs it back into the low-pressure area of the pump with sufficient force to seal off internal pressures. In operation (see inset in photo) the liquid flows through (1) the liquid box, inward past (2) the orifice plate and back into the pump. Shaft sleeve (3) turns with the shaft, but is not in contact with the orifice plate, so there is no point of wear. The diaphragm (4) provides a leak-proof seal while the pump is not



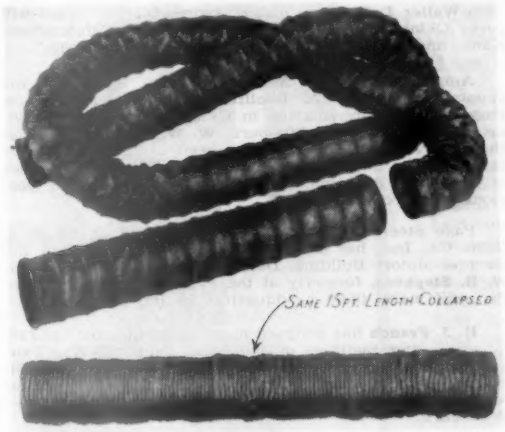
in operation, being pressed outward, by the pressure within the pump, against the shoulder of the shaft sleeve. There is no contact while the pump is turning, only momentarily when the pump is actually starting or stopping. Available in both bronze and stainless steel, for all pumps of 1-in. shaft and over. *Jet Shaft Seals, Inc.*

IT'S NEW CHECK IT

(9) NEW VERTICAL MOTOR is an addition to line of protected-type alternating-current motors. All ventilating openings are shielded against entrance of dripping liquids and falling particles. The oversize ball bearings carry thrust in addition to the rotor, and use of the patented centrifugal bearing seal allows use of softer grease for better lubrication. Has recessed junction box. Coils protected with vinylastic insulation. *Crocker-Wheeler Division, Joshua Hendy Iron Works.*

IT'S NEW CHECK IT

(10) "PORTOVENT" VENTILATING HOSE meets needs for metal reinforced light-weight large-diameter ducts which can be compressed into small space for transportation, and yet stay open around



sharp bends. Well suited for use with portable manhole and tank ventilators, portable air-conditioning, and heating and cooling units. Sectional construction allows assembly of any desired length from 2½-ft. sections. Readily coupled and uncoupled by hand, yet forms a tight joint not broken by jerks or pulls encountered in service. Special attachments for blowers or other air handling apparatus. Neoprene base compound covers the inside and outside surface. Diameter from 5 to 24-in. *American Ventilating Hose Co.*

IT'S NEW CHECK IT

OIL AND GAS EQUIPMENT Digest

IT'S NEW CHECK IT

(11) UCILON SURFACE COATING resists acid in commonly used concentrations and all alkalies and salts at ordinary temperatures, as well as alcohols, petroleum derivatives, and oils. Nontoxic, nonconductive, and inhibitive to fungus, the material can be used to protect surfaces of process equipment, piping, walls, beams, ductwork, tanks and so on. Produces an attractive glossy finish on metals, wood, or concrete. Available in white, clear, black, or colors, it is compounded from synthetic resins. Applied by brushing, dipping, or spraying. *United Chromium, Inc.*

TRADE LITERATURE

(12) PORCELAIN PLUNGERS. Six-page illustrated data sheet completely describes porcelain plungers which can be used on almost any hydraulic pump up to 2,000 psi. Gives complete construction details, specifications, types of service and purchasing information. *Aldrich Pump Co.*

IT'S NEW CHECK IT

(13) THE VISMETER. This instrument provides indication of viscosity by developing a pressure that is proportional to the viscosity, through the action of a single moving part, a rotor. Viscosity is read directly on a scale, uniformly divided. Booklet available. *Carl D. Miller.*

IT'S NEW CHECK IT

(14) MACHINING OF STAINLESS STEELS. Book contains 84 pages of reference data for machinists and estimating engineers. Gives recommended speeds for all standard grades of stainless steels for all operations. Quotes proper feeds for various types of equipment. Discusses tool compositions, cutting fluids and contains helpful tables. *Rustless Iron and Steel Corp.*

IT'S NEW CHECK IT

(15) TRAVELING BLOCK. Four-page, two-color, folder gives general specifications, lists prices. Cutaway drawings show all features of traveling block. Main features are its narrowness, capacity and staggered-sheave construction. *Regan Forge & Engineering Co.*

IT'S NEW CHECK IT

(16) INDEX TO CUTTING INFORMATION. Small booklet written for all those interested in the cutting of masonry materials and refractories. Illustrated, informative. *Clipper Manufacturing Co.*

IT'S NEW CHECK IT

(17) OBSERVATION DOOR. Four-page brochure describes new and revolutionary observation door for boilers, stills, and other types of furnaces. Printed in two colors, it lists 13 salient features, describes door in detail with pictures as well as drawings. Also contains installation diagram. *Bigelow-Liptak Corp.*

XUM

(18) OIL CAPITAL OF THE WORLD. Beautifully prepared brochures give a multitude of essential facts on Tulsa and Tulsa area. Each one highly illustrated and contains much useful information on buying power, climate, living conditions, cultural and recreational advantage, oil production, refinery capacity, natural-gasoline capacity, miles of pipe lines operated, etc. *Tulsa Chamber of Commerce.*

IT'S NEW ✓ CHECK IT

(19) EXTENSIBLE-TIP SPLICE. Booklet describes extensive tip designed to prolong life of endless belts with extended area stress relief. Contains numerous endless-belt-installation photographs and schematic diagrams describing the splice. Cites advantages. *Manhattan Rubber Mfg. Division.*

IT'S NEW ✓ CHECK IT

(20) MOTOR-GENERATOR MAINTENANCE AND REPAIR EQUIPMENT. Well-edited 40-page brochure contains hints on commutator care, troubles, and remedies. Maintenance equipment illustrated with instructions on proper use. *Ideal Commutator Dresser Co.*

IT'S NEW ✓ CHECK IT

(21) FLEXIBLE METAL HOSE. Pocket-sized booklet describes a line of flexible metal hose, gives uses, contains specification tables. Different types pictured in detail and one page is devoted to helpful hints on ordering. *Chicago Metal Hose Corp.*

IT'S NEW ✓ CHECK IT

(22) SALT OF THE EARTH. Attractive booklet describes a mechanical exhibit at Franklin Institute. Presents a simulated working model of a chlorine-alkali plant in actual operation. Booklet shows some of the current conceptions of the chlorine atom and the origin of the chemical and physical properties peculiar to this element. *Pennsylvania Salt Manufacturing Co.*

IT'S NEW ✓ CHECK IT

(23) RODS AND LINERS FOR SLUSH PUMPS. Folder giving information on stock sizes and prices is available. Liners and rods made from highest quality materials, and machined to precision A.P.I. standards. Special sizes made on request. *J. P. Machine & Tool Co.*

IT'S NEW ✓ CHECK IT

(24) SUBSTRUCTURES FOR DRAW WORKS AND POWER. A folder giving detailed illustrations, specifications, and information on adjustable substructures for all makes of rig. *Lee C. Moore & Co., Inc.*

W. A. DAVIS

H. G. HOWELL

N. B. HEDDEN

MEN IN THE NEWS

W. A. (Red) Davis, formerly district sales manager for Baker Oil Tools, Inc., Houston, Tex., recently resigned to become sales manager for F. L. LeBus Co. and LeBus Rotary Tool Works, Longview, Tex. The LeBus company recently announced its entry into the commercial drop forging and job machining fields.

Harry G. Howell, authority on factory management, is the new vice president of Tube Turns, Inc., Louisville, Ky., in charge of production.

N. B. Hedden has been appointed sales representative for the eastern and central states, by Vortox Co. of Claremont, Calif. His headquarters will be at Detroit.

A. C. Evans has been appointed by Norvell-Wilder Supply Co. as manager of the Tulsa office, 706 McBirney Building. Evans was with National Supply Co. from 1922 to 1944 and in 1944 and 1945 with the Empire Oil Field Machinery Co.

R. L. "Mike" Cain has been appointed assistant sales manager of Pennsylvania Salt Manufacturing Co., Philadelphia, Pa.

Acquisition of all patent and manufacturing rights of the Steel Building Division of Globe-Wernicke Co. has been announced by Butler Manufacturing Co. of Kansas City, Mo.

Allegheny Ludlum Steel Corp. of Brackenridge, Pa., has established offices at 306 Thompson Building, Tulsa, with **Walter T. Lewis** as district representative. Lewis will cover Oklahoma, Texas Panhandle, north to Hutchinson, Kans., and east to Joplin, Mo., and Fort Smith, Ark.

Ampco Metal, Inc., Milwaukee, Wis., announces the appointment of **N. A. Doolittle,** 1850 East 16th Place, Tulsa, as its representative in Oklahoma, Southern Kansas, and Southwestern Missouri. **W. W. Swan,** Carondelet Building, New Orleans, La., has been assigned a number of counties in Southeastern Texas in addition to the states of Louisiana, Alabama, and Mississippi that he has previously been covering.

Page Steel and Wire Division of American Chain & Cable Co., Inc., has established a new sales office in the General Motors Building, Detroit, Mich. **E. B. Brant** and **W. R. Stephens,** formerly at the Page plant at Monessen, Pa., will make their headquarters in the Detroit office.

H. J. French has resigned as assistant director for raw materials and facilities of the Steel Division, War Production Board, at Washington, D. C., and has resumed his duties as assistant manager of the development and research division of the International Nickel Co., Inc., at New York.

Leland I. Doan, vice president and director of sales of The Dow Chemical Co., has announced the appointment of **Donald Williams** as general sales manager and **Donald K. Ballman** as assistant general sales manager.

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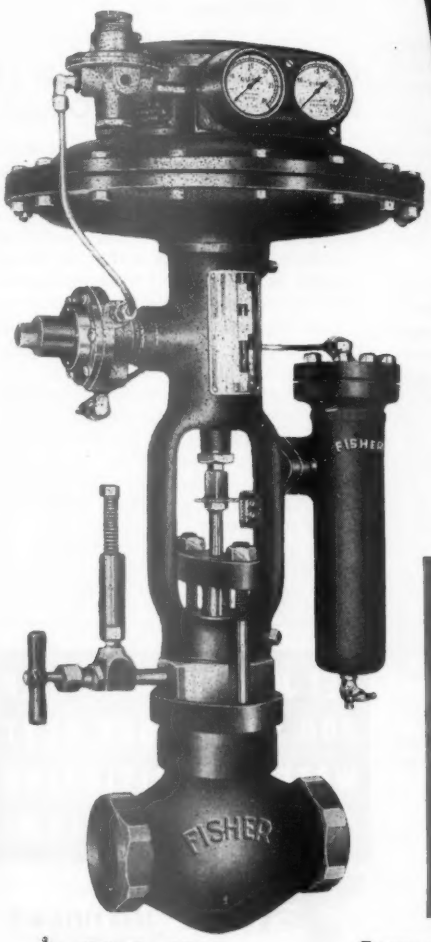
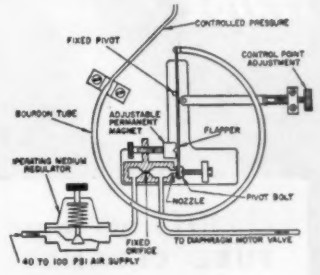
FULL AUTOMATIC "STOP COCKING" CONTROL FOR PRESSURE FLOWING OF FLUSH TYPE WELLS



Fisher field regulators, actuated by the NEW SNAP ACTING WIZARD PILOT, provide the finest possible two position on and off control for this service. Fully automatic, the pilot opens and closes the control valve in accordance with a predetermined operating range, permitting the well to flow only when adequate casing pressure has accumulated to raise the oil to the surface. Available for operating pressures up to 10,000 PSI with readily accessible adjustment of operating range.

Once installed and adjusted to the well requirements, Series 4101 regulators continue to control the flow *without attention* until the well is manually shut off.

The Snap Acting Series 4101 Pilot, provides two position on and off control. The pilot flapper is either held tightly against the orifice by the magnet or is pulled entirely away by the force built up in the Bourdon Tube. Thus the inner valve of the regulator is always tight closed or wide open. Snapping range is readily adjustable from 1% to 25% of the Bourdon tube rating and that range may be set at any point within the tube range.



Snap acting pilots are available in direct or reverse acting types, are enclosed in weather-proof cases for outdoor installation and are furnished with operating medium regulators and high pressure filter all integrally mounted and connected ready for installation. *Write for Bulletin D-2.*

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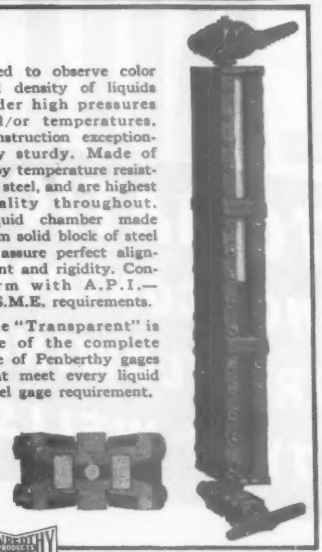
PENBERTHY
"TRANSPARENT"
DROP FORGED STEEL
LIQUID LEVEL GAGES

Used to observe color and density of liquids under high pressures and/or temperatures. Construction exceptionally sturdy. Made of alloy temperature resisting steel, and are highest quality throughout. Liquid chamber made from solid block of steel to assure perfect alignment and rigidity. Conform with A.P.I.—A.S.M.E. requirements.

The "Transparent" is one of the complete line of Penberthy gages that meet every liquid level gage requirement.



PENBERTHY INJECTOR CO.
DETROIT, MICH. Canadian Plant WINDSOR, ONTARIO

REFINING

Wisconsin Oil Man First to Operate German Plant

SHEBOYGAN. — Maj. John A. Crawford, who was general superintendent of the plant of Wisconsin Oil Refining Co., Inc., here when he entered war service in 1942, was the first Allied officer to be placed in charge of a German refinery. He has completed several weeks of reconstruction work at the plant in Misburg.

Writing to D. E. Foster, president and general manager of Wisconsin, Major Crawford told of the opportunities he had had "to see and work firsthand with the latest wartime refinery equipment." Several months of work with an Army unit formed to set up refineries outside the United States preceded his designation as a member of the Allied Control Council.

Major Crawford said the section of Germany where he was stationed was "in a terrible mess," with signs of oil-processing equipment nearly obliterated. The people, he said, plainly recognized a military defeat. He is now rebuilding another refinery at Bremen.

Three Refineries in List Of Surplus War Plants

WASHINGTON.—Three oil refineries are included in a list of surplus war plants offered for sale or lease by Reconstruction Finance Corp. They are the plants which during the war were operated by Root Petroleum Corp., at El Dorado, Ark.; Ashland Oil & Refining Co., Ashland, Ky., and Humble Oil & Refining Co., Baytown, Tex.

Arabian American Starts Operation of New Plant

NEW YORK.—Arabian American Oil Co., owned jointly by Standard Oil Co. of California and The Texas Co., has its new refinery at Ras Tanura, Saudi Arabia, on stream. It is expected to be processing 25,000 bbl. of crude daily by October 1 and to be operating at its capacity of 50,000 bbl. by the close of the year.

Full operation of the new plant will bring total capacity of Standard-Texas subsidiaries in the Persian Gulf area to 113,000 bbl. a day, 80,000 more than before the war. Bahrein Petroleum Co., affiliate of Arabian American, raised its capacity from 30,000 to 60,000 bbl. daily during hostilities.

H. D. Collier, president of Standard of California, announced the new Trans-Arabian Pipe Line Co., also jointly owned with The Texas Co., had begun negotiations for rights-of-way in preparation for building a line to the Mediterranean when conditions warrant.

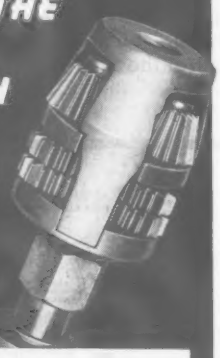
Chemists Reveal Details of Huge Aviation-Fuel Output

NEW YORK.—Research chemists of Magnolia Petroleum Co. have disclosed details of methods used in the control of processes for the synthesis of superfuels and blending agents which made possible the huge output of 100-octane aviation gasoline consumed during the war.

The superfuels, which are added to relatively low-octane gasoline (base stock) in order to raise the octane rating, are produced mainly by compressing certain abundant and cheap petroleum refinery gases to liquids and combining these liquids in the presence of liquid hydrogen fluoride, a highly corrosive acidic substance.

The process, called alkylation, is described in a report to the division of petroleum chemistry of American

TAKES THE TOUGH JOBS IN ITS STRIDE



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It's got power—speed—stamina.
It cleans fast and keeps going.
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Chemical Society by E. B. Butler, C. B. Miles, and C. S. Kuhn, Jr., of Magnolia's field research department.

The hydrogen fluoride acts as a catalyst and speeds up the chemical reactions whereby the superfuels are formed, but is not itself consumed by the reaction. It is an expensive chemical and must be recovered and recycled to the process. Special analytical methods were developed for determination of hydrogen fluoride and of the petroleum hydrocarbons in the plant streams.

To produce the superfuels the liquefied petroleum gases (isobutane plus olefins) are emulsified with the liquid hydrogen fluoride by means of violent agitation. These two substances are almost completely insoluble in each other, and separate into two liquid layers when not agitated. Small quantities of each dissolve in the other to an extent which varies with the temperature and which is greatly decreased by impurities, particularly water, in the hydrogen fluoride.

Because of the highly corrosive nature of the hydrogen fluoride and the high pressures involved, special apparatus and methods were developed to permit accurate quantitative measurements of solubilities. Furthermore, since hydrogen fluoride vigorously attacks glass, and direct observation of the two liquid layers in the experimental equipment could not be made, a new scheme for sampling each of these two liquid layers for analysis was developed.

Methods were worked out which permitted determination of as little as one-half part of hydrogen fluoride in 100 parts by weight of isobutane. The same methods were then applied to more complex systems and to other hydrocarbons with considerable success.

Research work on the limited mutual solubilities of these materials casts new light upon the chemical mechanism of the alkylation process and will be of value in developing chemical manufacturing processes employing petroleum hydrocarbons and hydrogen fluoride.

London Meeting Approves International Co-op Plan

KANSAS CITY. — Headquarters here of Consumers Cooperative Association has received word that the world cooperative conference just held in London "approved in principle" the plan of Howard A. Cowden, head of the association, for an international petroleum cooperative organization, controlled by national cooperative wholesales of various countries. Ownership would be held in the United States, England, Scotland, Sweden, France, South Africa, and other countries where the movement is highly developed. The whole range of oil products would be handled. A committee is to work out details of the new organization.

Pacific's New Cracking Unit to Go on Stream

LETHBRIDGE, Alta.—A new cracking unit has been completed at the Pacific Oil & Refining Co. plant here, and is to be placed in operation this month.

OIL and GAS
BURNING EQUIPMENT
NATIONAL
AIROIL
BURNERS
1236 E. Sedgley Ave.
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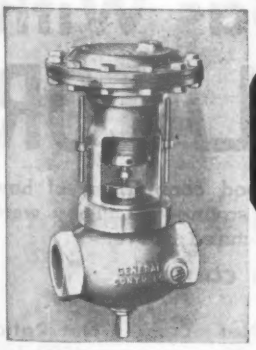
V-25-1
GAS FUEL
GOVERNOR

GENERAL CONTROLS'
V-25-1 Gas Fuel Governor, available in ⅜" to 3" I.P.S., will throttle gas lines according to the boiler pressure applied to the diaphragm. The best materials and advanced design are incorporated in this control, such as ball bearing thrust adjustment, ground and polished non-corrosive stems, low friction packing gland seal, multiple calibrated springs, and high lift for maximum capacity. For butane, natural or manufactured gas.

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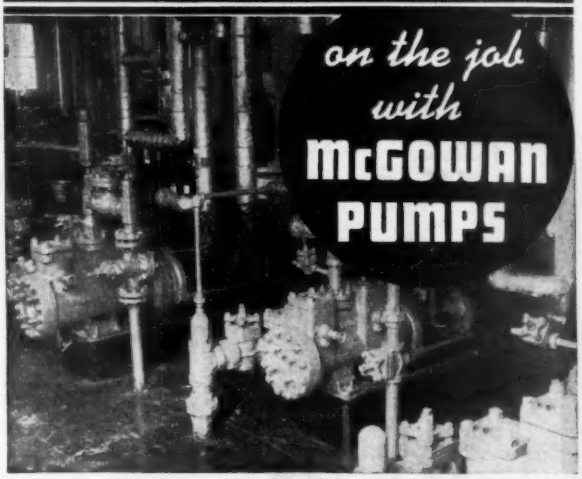
GASOLINE PLANTS AND REFINERIES

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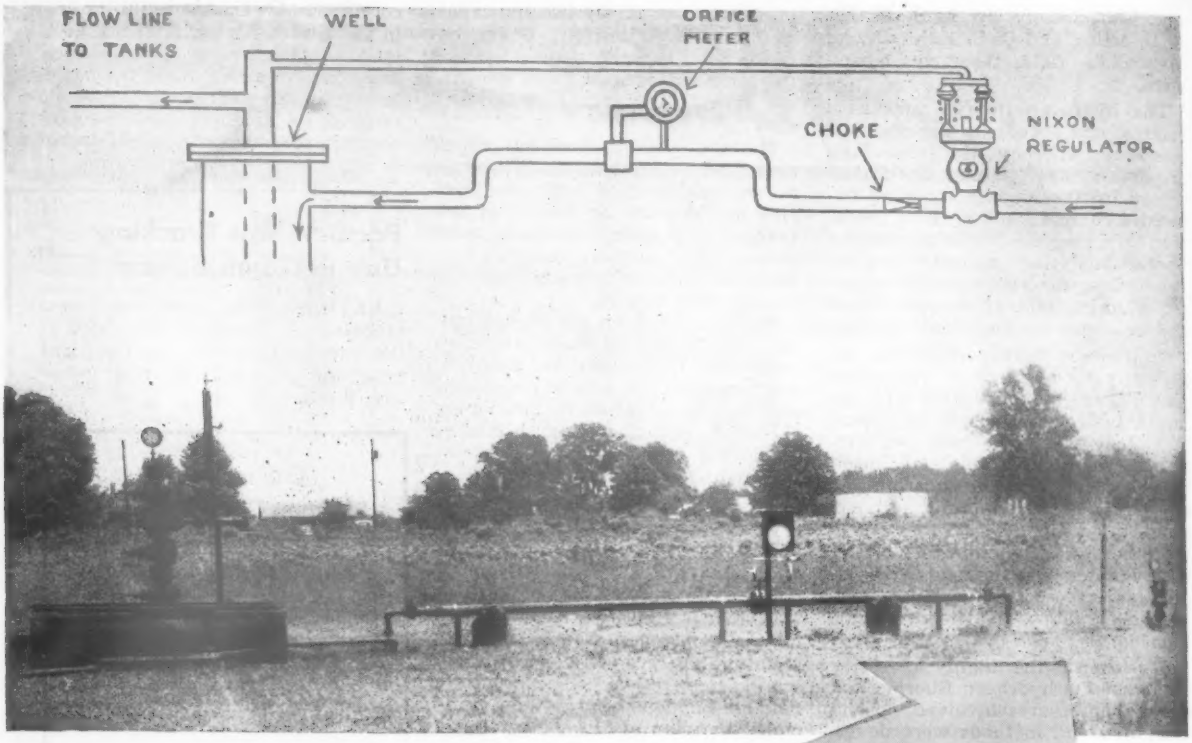
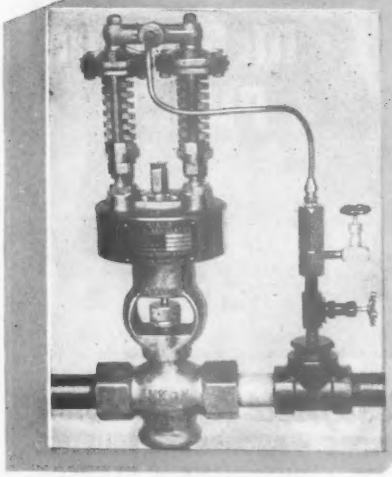


When Producing With Jet Collars ... Proportion Your Input Gas With a NIXON REGULATOR



The figures shown below furnish a good comparison of how the Nixon Regulator pays dividends by saving gas. They were taken "before and after" on the well pictured above.

WELL EQUIPPED WITH JET COLLARS
Straight Lift

Date	MCF	Net	Net/Ratio
3-29-45	151.8	33	4600/1
4- 5-45	127.0	27	4650/1
5-13-45	152.1	33	4610/1
5-16-45	132.1	29	4625/1

WELL EQUIPPED WITH JET COLLARS
and with Nixon Regulators

5-25-45	26.8	36	745/1
5-26-45	25.4	30	848/1
5-27-45	27.5	30	914/1

*A reduction in ratio of input gas of from 4621 cu. ft. to 836 cu. ft. per barrel of fluid lifted.

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SALES OFFICES: Tulsa, Oklahoma; Dallas and San Antonio, Texas. LOS ANGELES: Western Pressure Control, 5700 Santa Fe Ave. TRINIDAD, B. W. I., Neal Massey Eng. Corp.

BRANCH STORES: TEXAS—Kilgore, Beaumont, Barbers Hill, Bay City, Monahans, Alice, Victoria, Corpus Christi. LOUISIANA—Lake Charles, New Iberia, Harvey, Shreveport. ARKANSAS—Magnolia. MISSISSIPPI—Natchez.

Natural Gas

Seeks Right to Export Gas From Texas to Mexico

WASHINGTON.—Sam L. Miller, of McAllen, Tex., has petitioned Federal Power Commission for authority to export a maximum of 20,000,000 cu. ft. of natural gas daily from Texas to Mexico. Miller proposes to move the gas from wells in Starr and Hidalgo counties for sale and delivery at a point on the international boundary to Cia. Petroleos Mexicanos. The latter agency would transport the gas to Monterrey, for sale and distribution in and near that city for domestic and industrial use.

The respective structures from which the gas is to be produced in Texas are said to be common to both countries, with that portion of the structure in either country subject to drainage by wells in the other country. The application recites that the type of sand formation comprising these particular gas reservoirs has such porosity and permeability that a single well, tapping one of the reservoirs would, in time, exhaust the reservoir, and the number of wells and rate of production in one country would determine the period of time within which all recoverable gas in storage in that portion of the reservoir located in the other country would be exhausted.

Panhandle Eastern Rates Subject to FPC Hearing

WASHINGTON. — Federal Power Commission held a public hearing September 24 on a revised schedule of natural-gas rates proposed by Panhandle Eastern Pipe Line Co. The company produces gas in Oklahoma and Kansas and pipes it to industrial consumers and utility companies in Texas, Kansas, Missouri, Illinois, Indiana, Ohio, and Michigan.

Panhandle Eastern was ordered by the commission in 1942 to reduce its rates approximately $5,000,000 a year. The Supreme Court affirmed the decision. Last April the company filed a new schedule of rates.

Reynosa Pipe-Line Case to Be Heard December 12

WASHINGTON.— Federal Power Commission has postponed to December 12 its hearing, previously set for October 3, on an application of Reynosa Pipe Line Co. for permission to export up to 60,000,000 cu. ft. of natural gas daily from Texas to Mexico.

FPC last May 8 dismissed without prejudice Reynosa's application for authority to export gas, mainly for use by industries in the Monterrey area, on the ground that such exportation would be inconsistent with the public interest. The commission pointed out that no adequate showing had been made concerning the possibility of obtaining natural-gas supplies within Mexico. On July 5 the commission granted the company a rehearing on the latter's statement that it had additional evidence to offer.

Cabot Cancels Proposed Increase in Gas Rates

WASHINGTON.—Cabot Gas Corp. has canceled its proposed increase in rates for natural gas sold at wholesale to The Pavilion Natural Gas Co. for resale in western New York. The proposed rates would have raised the cost of the gas from 40 cents a thousand to 56 cents, with a yearly increase to consumers of about $44,500.

The proposed rates, filed last June 18, were suspended, without becoming effective, by the commission's order of July 10. The cancellation eliminated necessity for the hearing scheduled to begin September 25. Since 1937 Pavilion has been purchasing from Cabot a substantial part of the natural gas it distributes in New York communities.

Hearing of Pittsburgh's Rate Case Postponed

WASHINGTON.—The hearing in the rate case initiated by the city of Pittsburgh, involving Pittsburgh & West Virginia Gas Co. and Kentucky West Virginia Gas Co. and to have been held by Federal Power Commission September 24, was postponed to a date to be set later. Circumstances had arisen which made it "impossible" to proceed," according to FPC.

The city filed a complaint last March setting forth that Pittsburgh & West Virginia Gas Co. sells natural gas in interstate commerce to Equitable Gas Co., a wholly owned subsidiary which distributes gas at retail in Pittsburgh and surrounding territory. Gas sold by Kentucky West Virginia Gas Co. to its affiliate Pittsburgh company, is sold in turn by the latter company to Equitable. The complaint alleges the rates charged by the Kentucky company for the sale of natural gas to the Pittsburgh company and by the Pittsburgh company to Equitable are unreasonable and in contravention of the Natural Gas Act.

Communities in Southern Wisconsin to Have Gas

WASHINGTON.—Pointing out that granting of Wisconsin Southern Gas Co.'s petition will insure southeastern Wisconsin with maintenance and continuity of adequate gas service, Federal Power Commission has: (1) directed Natural Gas Pipeline Co. of America to extend its transportation facilities to establish connection with those of Wisconsin Southern Gas Co. at the Illinois-Wisconsin state line near Genoa City, Wis., and to sell natural gas to the latter company for distribution to its customers in southeastern Wisconsin; and (2) authorized Wisconsin Southern to construct and operate a 4½-in. transmission main extending northward from this connection for 50,000 ft. to the company's existing facilities at Lake Geneva, Wis., with necessary appurtenances.

Wisconsin Southern proposes to discontinue the manufacture of water gas and convert its system to use straight natural gas.

Detroit Wants More Gas From Texas and Kansas

WASHINGTON. — Federal Power Commission has been notified by Detroit that the city needs increased deliveries of natural gas from Texas and Kansas. The city and Wayne County filed a joint petition that FPC order Panhandle Eastern Pipe Line Co. to increase its transportation facilities from those states.

The petitioners also asked voiding of certain provisions of a contract between Panhandle, the wholesale supplier, and Michigan Consolidated Gas Co., the distributor in city and county.

These provisions, they contended, limit gas deliveries for Michigan Consolidated to 125,000,000 cu. ft. daily, require the distributing company to manufacture augmenting quantities of artificial gas, and prevent purchases of natural gas for storage against peak demands.

Michigan's public service commission is opposing an effort of Panhandle to obtain FPC's permission to export natural gas to Canada.

WHY DO 3 JOBS TO GET ONE DONE?

A Practical Suggestion to Users of Steel Pipe Protection . . .

In an operation as important as pipe protection, it takes time and costs more money to order coatings from one source, wrappings from another and application from still a third.

You benefit in every way by letting Pipe Line Service take care of *all* these details, in connection with mill or railhead coating and wrapping.

Thus you have only one order to write. You save time, trouble and money. There is no divided responsibility—no chance of slip-ups. You get full satisfaction on every coating and wrapping job.

That's why it will pay you to call in PLS pipe protection specialists on your next job.

Write for descriptive bulletin.

COMPLETE is the Word for Pipe Line Service

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  - —At the Mill
  - —At Yard or Railhead
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- Pipe Cleaning Service
- Pipe Storage
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Corpus Christi, Texas and Harvey, La.

PIPE LINES

Utah Pumps Oil From Rangely

Utah Oil Refining Co. commenced pumping crude oil on September 20 through the recently completed 151-mile 10-in. line from Rangely, Colo., to Wamsutter station, Wyoming. Temporary pumping equipment is being utilized until permanent facilities can be installed for operation to start in January. This is part of Project 37 authorized by the Petroleum Administration for War which also included the laying of 25 miles of 8-in. between Uintah junction and Salt Lake City.

Stanolind Pipe Line Co. has laid 16 miles of the 22 miles of 6-in. in connection with the Wind River, Wyoming, project for which 69 miles of 8-in. is to be laid from Pilot Butte to Lysite, Wyo.

Interstate Prepares To Lay Extension

Interstate Oil Pipe Line Co. has requested bids from pipe-line contractors for the laying of 32 miles

PIPE-LINE PERSONALITIES

OSCAR RUTHO BURDEN, general superintendent, War Emergency Pipelines, Inc., son of Dr. Charles T. Burden and Julia Katherine (House) Burden, was born in Poplar Bluff, Mo.

He attended school in northern Indiana where he worked weekends and vacations for Indiana Pipe Line Co. and Salamoni Gas Co. In January 1910 he went to Tulsa and engaged in rig-building.

At Corsicana, Tex., he started with Texas Pipe Line Co. as laborer in the connection gang. In 1911 he went to Dallas, where he kept time, was fireman, engineer, dirt foreman, right-of-way foreman, gang foreman, etc.

In 1917 Burden was transferred to the Louisiana-Arkansas division, working first as gager, then as district foreman; he had charge of the Pine Island and Smackover districts during the boom period. In 1923 he was at Mexia, Tex., as district foreman during the Powell boom.

At Wichita Falls, in 1924 he became assistant superintendent of the North Texas division of the Texas Pipe Line Co. In 1926 he was promoted to division superintendent. He supervised one of the first electrically welded oil lines from the Panhandle to Electra.

In 1932 he was assigned the construction of 230 miles of 12-in. line from East Texas to Port Arthur. Right-of-way was procured, the line strung, welded, and placed in operation in 30 days, a world's record for pipe-line construction.

During 30 years with the Texas Pipe Line Co., he was active in civic affairs, serving as president of Hardin Junior College and in the same capacity for Wichita Falls public schools, Chamber of Commerce, Community Chest, Kiwanis Club, Wichita Club, Northwest Texas Council of Boy Scouts of America, etc.

In 1939 he left Texas Pipe Line Co. and joined Panhandle Producing and Refining Co. as vice president and general manager.

On resigning in 1941 he formed two partnerships, Burden-Riley Drilling Co., and Burden and Wright Pipeline Construction Co.

In 1942 he joined War Emergency Pipelines, Inc., as general superintendent.

He is married to the former Joyce Johnson of El Dorado, Tex., and has two sons: Tom, age 7, and Jack, who is 18 and in the Navy.

of 10-in. crude-oil line to connect the Gwinville, Miss., producing area with the company's trunk system completed this summer for moving Mississippi oil to Baton Rouge, La. Construction of the Gwinville extension is to start in October.

Southern Natural Planning To Expand Facilities

WASHINGTON.—Southern Natural Gas Co., Birmingham, has been authorized by Federal Power Commission to construct and operate about 116 miles of 22-in. to 6⅝-in. natural-gas pipe line in Louisiana, Georgia, Alabama, and Mississippi; a 1,200-hp. compressor station on the Montgomery-Columbus branch line near Wetumka, Ala., and other needed facilities. The additions estimated to cost $3,771,760, will increase the company's daily delivery capacity from the present 220,000,000 cu. ft. to 245,000,000.

Chicago District to Expand Pipe Lines

Anticipating increased demands for gas in this immediate postwar period, the Chicago District Pipeline Co., which provides natural gas for the four gas utilities serving the Chicago area, plans to spend $1,425,000 to increase pipe-line facilities for bringing gas to the city.

The Chicago District Pipeline Co., a subsidiary of the Peoples Gas Light and Coke Co., hopes to make available through the expanded facilities an additional 50,000,000 cu. ft. of natural gas daily to Public Service Co. of Northern Illinois, Western United Gas and Electric Co., Northern Indiana Public Service Co., and to its parent company.

Congress Told to Consider WEP

Congress has been told it should concern itself with the disposition of the big-inch and little-inch systems of War Emergency Pipelines, Inc.

Referring to an announcement by the Reconstruction Finance Corp. that the pipe lines will soon be closed preparatory to selling or leasing them, Representative Voorhis of California said the facilities cannot be sold under the Surplus Property Act until a report on them is made to Congress.

"There are some questions about this matter which I think need very much to be asked by Congress," Voorhis said.

One of these, he continued, concerns the desirability of making the pipe lines into "true common carriers" for the benefit of consumers and small and independent producers.

Consideration also should be given as to the advisability of draining and sealing up the lines, Voorhis said.

The value of crude oil and products in the WEP lines has been normally the same as the inventory on June 30, 1945, which was as follows: 24-in. line $4,702,950; 20-in. line $9,332,004; total $14,034,954.

The prices at which RFC is moving crude oil and products through the WEP lines this month are equivalent to those that would be charged for movement by tanker and by combined tanker and pipe-line routes from the Gulf Coast to the eastern seaboard.

PIPE LINES

FRANK E. RICHARDSON

CONSULTING ENGINEER

904 INSURANCE EXCHANGE BLDG.

KANSAS CITY 6, MISSOURI

BUCKEYE MAINLINERS

for faster digging of trenches for crude lines. Digs trench 24" to 39" wide — up to 8½" deep.

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TRENCHERS. SHOVELS. CRANES

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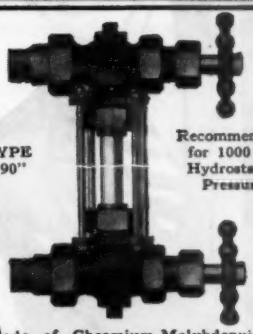
LIQUID LEVEL GAGES



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Recommended for 1000 lb Hydrostatic Pressure

Made of Chromium-Molybdenuin alloy temperature resisting steel, extra heavy throughout and stainless steel trimmed. Positive automatic shut-off; stainless steel balls shut off the flow of liquid if glass breaks. Regrinding removable seats, heavy duty stuffing boxes, union connections. Conform with A.P.I.—A.S.M.E. requirements.

This is one of the complete line of Penberthy gages that meet every liquid level gage requirement.

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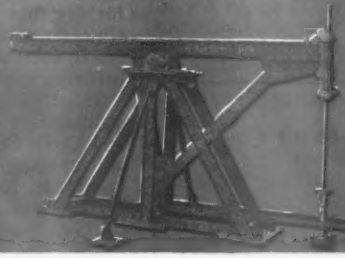
No. 405 Capacity	2,000 lbs.
No. 407 "	3,000 lbs.
No. 408 "	4,500 lbs.
No. 509 "	6,500 lbs.
No. 610 "Utility" "	7,500 lbs.
No. 610 Capacity	8,0
No. 710 "	10,0
No. 812 "	12,0
No. 915 (Illustrated) "	16,0



NORRIS COUNTER-BALANCED JACKS

STROKE POSTS

Send for BULLETIN No. 26

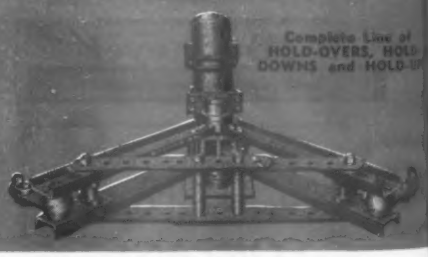
	Rod Line Load Capacity
Type "L" Adjustable Stroke Post	8,000 lbs.
6" x 5' Universal Pendulum Stroke Post	10,000 lbs.
7" OD Multiplier or Stroke Post	10,000 lbs.
Clamp Type Pendulum Multiplier or S. P.	12,000 lbs.
No. 812 Counter-Balanced Stroke Post	14,000 lbs.
Type "M" Adjustable Stroke Post	14,000 lbs.
No. 915-W, 915-TOW and 920-TOW Counter-Balanced Stroke Post (Illustrated)	26,000 lbs.

BELL CRANK used in specialized applications for pumping one or more wells off pumping unit or gear box.

SWINGS

Send for BULLETIN No. 27

	Rod Line Load Capacity
Type "L" Swings, regular and adjustable	8,000 lbs.
Swings: Type "RS"	8,000 lbs.
"HS"	8,000 lbs.
"EHS"	10,000 lbs.
Regular Link Type Swing	16,000 lbs.
Regular Adjustable Link Type Swing	16,000 lbs.
"TO" Link Type Swing	20,000 lbs.
180° Trussed Swing 6 inch	8,000 lbs.
8 inch	20,000 lbs.
180° Swing with Center Reinforcing Plate 10 inch	10,000 lbs.
12 inch	16,000 lbs.



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ARMY NAVY QUALITY NORRIS MARKS FRIENDS

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ROOM 1940, 30 ROCKEFELLER PLAZA, NEW YORK CITY

Exploration and Drilling

Week's Highlights

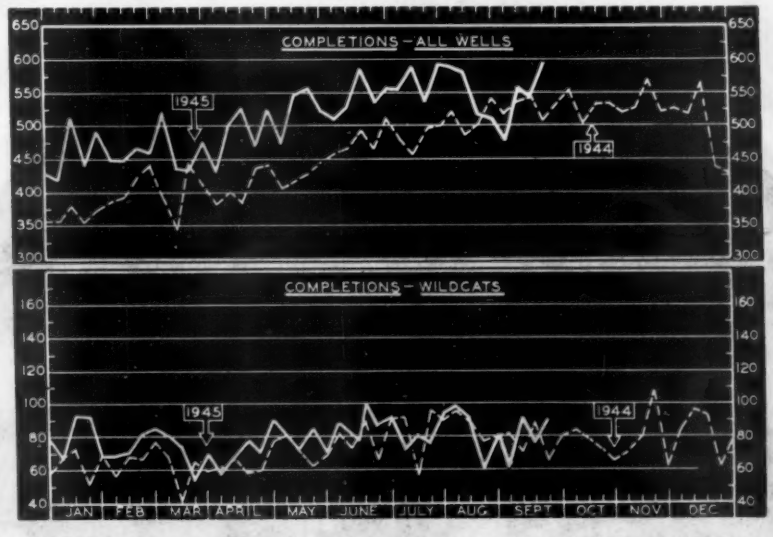
AFTER a comparative lull, Mississippi wildcatters appear to be having more luck again. The latest potential field opener is in Adams County on the west side of the state, where Charles H. Osmond 1 Armstrong-Ellislie, in fractional Section 31, west side of 31-5n-2w, is showing for a gas condensate producer from the Massive sand.

This appears to be another salt dome field about 17 miles southwest of the Cranfield pool and 12 miles southeast of Carthage Point. Reports are that samples and side-wall cores from the Massive sand carried a gas distillate odor from 11,105-95 ft.

Structural trends seem to mean nothing in the salt dome basin of Mississippi. The domes are scattered at random and are reasonably easy to detect by geophysical methods. Whether regional sedimentary conditions can be worked out that will give a clue as to why some dome traps produce oil and others do not is generally not known.

In absence of more specific geological data, all domes in an area where several have been found productive will be given more thorough testing than domes in other areas where only one or none of these tested have produced. Both geological and empirical data show that when a good petroliferous area is found, all traps are reasonable prospects.

This line of reasoning will probably result in more testing in the western part of Mississippi and across the line in Louisiana. The area in which Holly Ridge, Lake St. John, Bruinsburg Gas, Fayette, Cranfield, Natchez, and the new po-

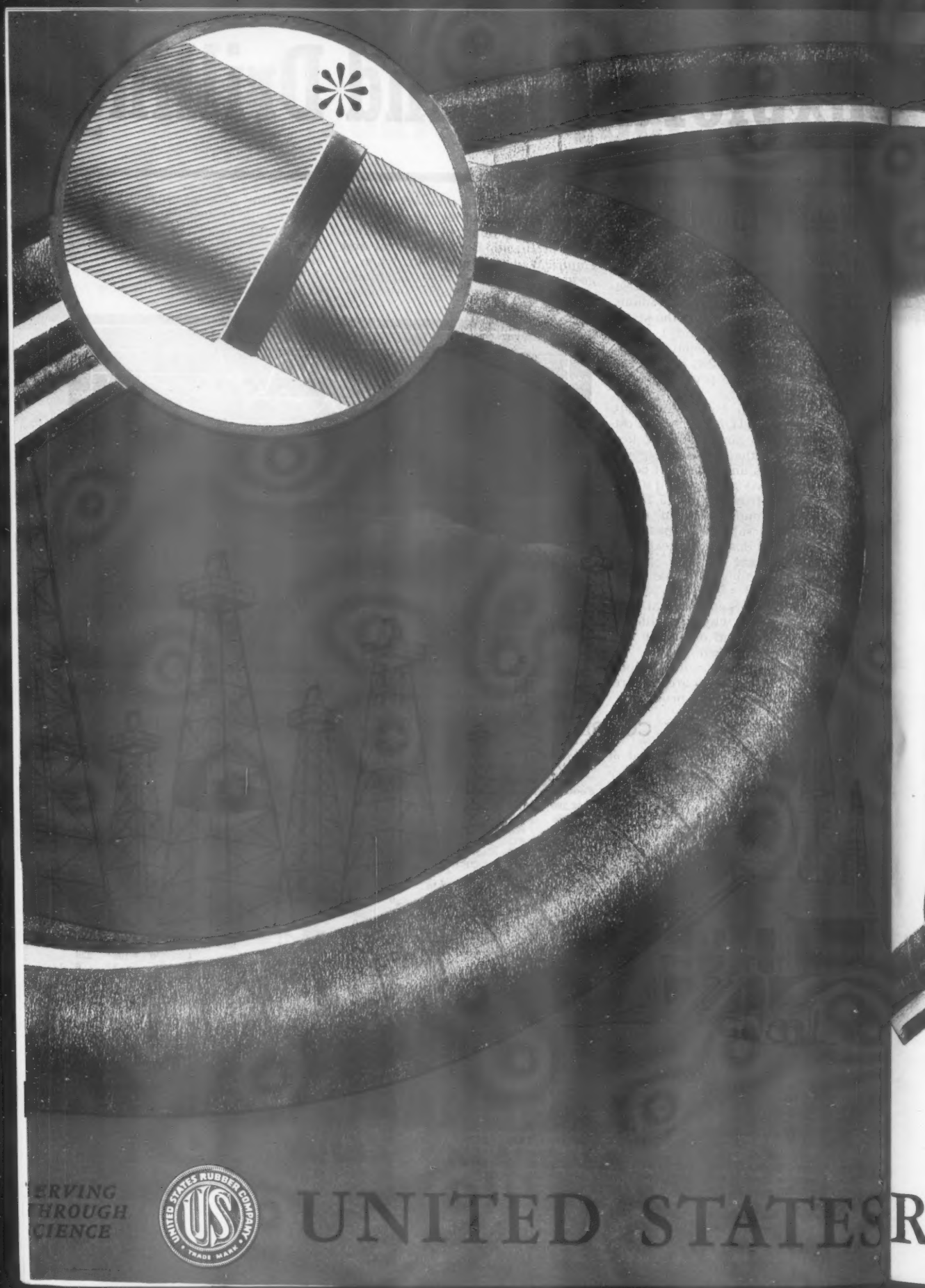


Solid line charts current weekly completions, service wells in Eastern area included

WEEKLY WELL COMPLETIONS . . . WEEK ENDED SEPTEMBER 22, 1945

	Total of all wells					Cum. to date		Wildcat completions and discoveries					Cumulative total, 1945				
	Comp.	Oil	Gas	Dry	Footage	1945	1944	Oil	Dist.	Gas	Dry	Total	Oil	Dist.	Gas	Dry	Total
New York	34	17	0	*17	48,280	1,053	1,152	0	0	0	0	0	0	0	0	0	0
Pennsylvania	77	39	9	†29	125,286	2,993	2,970	0	0	0	0	0	0	0	0	0	0
West Virginia	16	1	11	4	43,199	588	627	0	0	0	0	0	0	0	0	0	0
Ohio	26	4	9	13	65,456	673	719	0	0	0	2	2	0	0	11	44	55
Indiana	12	5	2	5	28,817	145	178	0	0	0	0	0	5	0	0	22	27
Kentucky	10	4	4	2	21,278	377	531	0	0	2	2	4	19	0	4	38	61
Illinois	49	28	0	21	127,628	1,293	1,343	1	0	0	11	12	36	0	0	231	267
Michigan	14	3	0	11	31,560	535	458	0	0	0	8	8	7	0	3	189	199
Kansas	43	23	6	14	130,460	1,236	1,308	1	0	0	5	6	27	0	12	247	286
Neb., Mo., Iowa	0	0	0	0	0	18	28	0	0	0	0	0	0	0	0	13	13
Oklahoma	59	29	9	21	242,657	1,748	1,285	0	1	0	5	6	64	3	15	265	347
Texas	151	81	14	56	685,247	5,185	4,011	5	0	2	34	41	157	12	47	921	1,137
North Central	51	29	2	‡20	151,538	1,578	1,067	2	0	0	10	12	60	0	5	324	389
West	36	33	0	3	161,039	1,300	1,118	1	0	0	3	4	42	1	0	186	229
Panhandle	7	1	5	1	22,595	402	184	0	0	0	0	0	0	0	1	5	6
Eastern	10	2	3	5	71,391	245	235	0	0	0	4	4	5	6	1	62	74
Gulf Coast	36	14	2	20	238,199	1,179	897	2	0	1	13	16	37	4	31	208	280
Southwest	11	2	2	7	40,485	481	510	0	0	1	4	5	13	1	9	136	159
Louisiana	27	19	1	7	142,620	753	581	0	0	0	1	1	24	3	6	92	125
Northern	14	9	1	4	31,234	297	230	0	0	0	1	1	6	1	6	52	65
Southern	13	10	0	3	111,386	456	351	0	0	0	0	0	18	2	0	40	60
Arkansas	3	3	0	0	15,712	127	158	1	0	0	0	1	1	0	0	28	29
Mississippi	13	7	0	6	94,796	266	103	0	0	0	5	5	5	0	0	88	93
Southeastern	0	0	0	0	0	43	35	0	0	0	0	0	0	0	1	30	31
Montana	4	3	0	1	7,313	231	260	0	0	0	0	0	7	0	0	19	26
Wyoming	5	4	0	1	21,025	154	124	0	0	0	0	0	14	0	1	29	44
Colorado	8	6	0	2	47,669	36	27	0	0	0	2	2	1	0	1	7	9
New Mexico	3	1	0	2	7,251	305	282	0	0	0	1	1	8	0	4	45	57
California	42	31	2	9	182,169	1,681	1,439	0	0	0	1	1	2	0	2	167	171
Total United States	596	308	67	221	2,068,423	19,440	17,619	8	1	4	77	90	377	18	107	2,475	2,977
Total previous week	536	303	54	179	1,867,131	18,844	17,110	10	0	4	62	76	369	17	103	2,398	2,887
Total Sept. 23, 1944	518	280	55	183	1,583,876	17,619	12,608	6	0	4	55	65	320	20	94	2,324	2,758

Service wells included: *17, †27, ‡2.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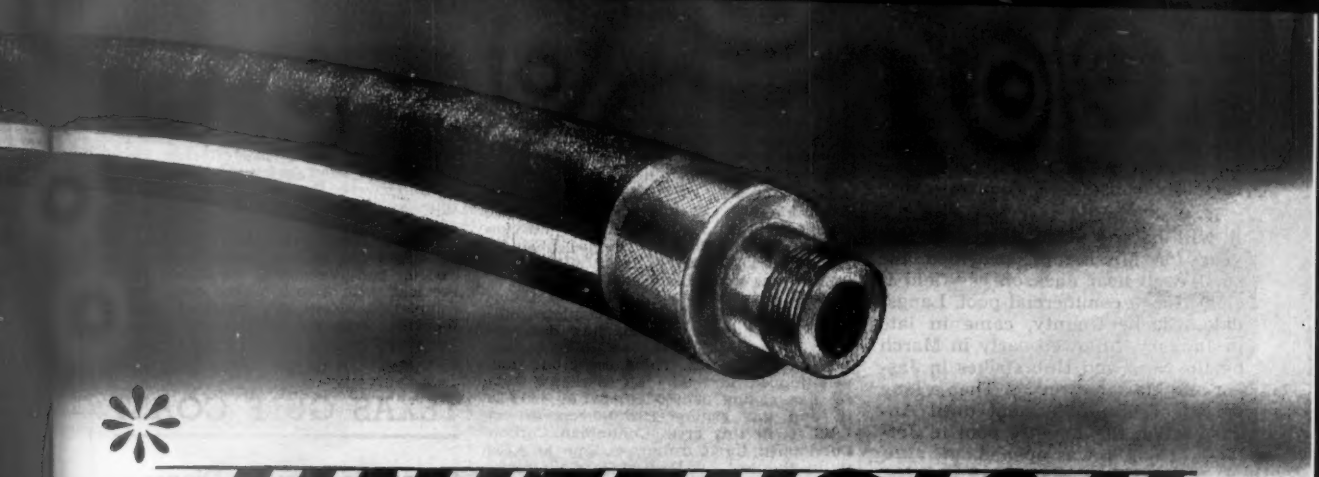

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tential field, are all clustered may prove to be one of those rich petroliferous regions. At this time there may not be any easily discernible reason for this, but just on that basis all traps in that area will be carefully considered as prospects.

If the Osmond test is successful, it will be the sixth new pool this year for Mississippi, provided the small well near Jackson gas field is classed as a commercial pool. Langsdale, Clarke County, came in late in January, followed early in March by the Soso and Hub strikes in Jasper and Marion counties. Then a long period of disappointment until August, when the Fayette pool in Jefferson County was opened.

APPALACHIAN FIELD

Largest Recent Gasser Completed in Tiona

PITTSBURGH. — In Washington Township, Indiana County, southwest Pennsylvania, Peoples Natural Gas Co. completed a test on C. L. McCurdy farm which had a final open flow of 6,286,000 cu. ft. gas from the Tiona sand topped at 3,009 ft. and gas at 3,014 ft. It had a rock pressure of 1,210 lb. in 12 hours from a total depth of 3,024 ft. This is the largest Tiona gas well of recent years.

In Morris Township, Greene County, J. L. Dunn et al completed a test on W. M. Dunn farm in the Injun sand good for 564,000 cu. ft. gas. The sand was topped at 2,141 ft., with gas at 2,143-45 ft., where it was bottomed.

There were two new locations in Kittanning and Bethel townships, Armstrong County, and one in Amwell Township, Washington County.

In Logan district, Logan County, West Virginia, Columbian Carbon Co. topped the Injun sand at 2,363 ft. in 795 Island Creek Coal Co. and shut down at 2,389 ft. to acidize and test the Injun said oil. It is reported to have made 100 bbl. in 2 hours 40 minutes after acidizing.

In Falls district, Fayette County, Columbian Carbon Co. completed 4 Gauley Mountain Coal Co. with a gage of 1,050,000 cu. ft. gas after acidizing. The Maxton sand was at 1,220 ft. with gas 1,232 ft., Big Lime 1,388-1,618 ft., gas 1,471 ft. and 1,525-30 ft., total depth 1,656 ft.

In Ravenswood district, Jackson County, United Fuel Gas Co. completed another Oriskany well in the new development with 5,659 H. O. McCauley testing 4,525,000 cu. ft. gas. The Corniferous lime was topped at 4,809 ft., Oriskany 4,917 ft., gas gaging 327,000 cu. ft. at 4,917-20 ft. and gas gaging 4,321,000 cu. ft. at 4,949 ft. In this area, Columbian Carbon Co. topped the Corniferous lime at 4,859 ft. in the test on Delbert E. Cole farm.

In Tucker County, the important wildcat of Ohio Oil Co. on Kuykendall Unit in Dry Fork district is drilling at 8,390 ft. or 140 ft. below the top of the Oriskany sand where there was a show of gas in the mud. A drill-stem test will be made.

SOUTH LOUISIANA

Humble Opens New Sand For Avery Island

NEW ORLEANS. — A new sand for Avery Island field in Iberia Parish is being opened by Humble Oil & Refining Co. at its 7-B Petit Anse Co., 23-13s-5e. This well is testing for completion through 113 perforations at 8,648-65 ft. On previous test it flowed at the rate of 367 bbl. daily through a 10/64-in. choke, gravity 34°, gas-oil ratio 799 to 1. Total depth is 8,848 ft.

Activity in the south Louisiana district continues to increase with five new wildcat starts having been reported this week. Deeper drilling continues with five of the tests reported this week contracted to 12,000 ft. or deeper. Two wildcat tests, Continental Oil Co. and Yegua Corp. 2 A. Dobbertine in Johnson Bayou area, Cameron Paris, and The Texas Co. 1 State-Barataria Bay in Jefferson Parish, are going ahead below 13,000 ft.

There were 18 new locations reported this week, 5 being wildcats, 3 in Beauregard Parish, and 1 each in Iberville and Jefferson Davis parishes. All 13 completions were in proven areas, Acadia, Calcasieu, and Vermilion parishes sharing the lead with 2 completions each. Only 3 completions were dry holes, 1 each in Iberville, Jefferson Davis, and St. Landry parishes.

DAILY AVERAGE PRODUCTION FOR WEEK

	Sept. 22 crude oil	Distillate, allied products	September PAW quota all oils	Sept. 15 crude oil
Alabama	250	.....	500	1,000
Arkansas	78,000	5,400	80,400	78,800
California	885,750	60,970	946,970	883,250
Colorado	11,650	.....	12,000	11,550
Eastern	63,950	6,300	72,500	60,000
Florida	Shut in	.....	.....	.....
Illinois	204,550	12,000	212,000	201,450
Indiana	13,200	.....	13,000	13,100
Kansas	273,450	4,500	278,500	273,600
Kentucky	29,500	2,600	30,600	28,150
Louisiana	363,800	42,000	392,000	363,200
North Louisiana	71,800	.....	.....	71,200
South Louisiana	292,000	.....	.....	292,000
Michigan	45,100	800	47,800	51,100
Mississippi	51,050	.....	47,000	53,700
Montana	23,300	300	22,300	23,300
Nebraska	850	.....	1,000	850
New Mexico	107,300	6,800	106,800	107,250
Oklahoma	394,600	28,000	408,000	392,050
Texas	1,889,500	166,000	2,144,000	1,889,500
East Texas	315,300	.....	.....	315,300
East Central Texas	128,450	.....	.....	128,450
North Central Texas	141,900	.....	.....	141,900
Texas Panhandle	88,000	.....	.....	88,000
West Texas	452,000	.....	.....	452,000
Southwest Texas	296,150	.....	.....	296,150
Texas Gulf Coast	467,700	.....	.....	467,700
Wyoming	101,550	3,500	96,700	104,750
Total United States	4,537,350	339,170	4,912,070	4,536,600
Change from previous week	up 750			

Total production January 1-September 22, 1945 ..... 1,273,055,575 bbl.
Same period last year ..... 1,200,492,910 bbl.

TEXAS GULF COAST

Colorado County Discovery Flows 124-Bbl. Potential

HOUSTON.—The new discovery, Cities Service Oil Co. et al 1 John Schobal, in James Tumlinson League, Colorado County, flowed a potential of 124 bbl. per day through a ¼-in. choke, gas-oil ratio 11,000 to 1, tubing pressure 1,300 lb., casing pressure 1,075 lb. Gravity is 36°, no water. This well is northeast of the gas-condensate discovery well at Columbus field in Colorado County. Drilled to a total depth of 9,752 ft., top of sand 7,820 ft., pipe was perforated with 12 shots from 7,857-59 ft. This well also had shown gas-condensate production on tests at the 8,100, 8,300, 8,500 and 8,800-ft. levels.

One mile east extension at Pinehurst field, Montgomery County, Pan American Production Co. 1 J. M. Winslow, has been dually completed with the upper sand, 10,325-45 ft., flowing a potential of 78 bbl. of 50° gravity condensate per day through a 20/64-in. choke, gas-oil ratio 24,628 to 1, casing pressure 1,100 lb., plus 20 per cent water; and the lower sand, 10,985-11,004 ft., potential being 96 bbl. of condensate per day through a ¼-in. choke, tubing pressure 2,950 lb., no water. Total depth is 11,145 ft., with 5½-in. casing set to 11,143 ft.

Cecil Hagen and Jack W. Frazier 2 A. A. Mullins, in S. F. Austin Survey, Boling flank test, Wharton County, flowed a potential of 358 bbl. per day through a ¼-in. choke through 96 perforations at 2,376-2,404 ft. Tubing pressure was 320 lb., casing pressure 450 lb., no water. Total depth is 2,692 ft. with 5½-in. production casing set to bottom. Gas-oil ratio was 400 to 1.

Jack W. Frazier 1 Mrs. W. S. Dixon et al, wildcat in Uriah Gibson Survey, 1 mile southeast of Shepherd, San Jacinto County, was dry at total depth of 8,511 ft., no shows reported.

There were 11 new locations reported this week, all in proven areas. Of the 15 completions 6 were wildcats, 1 oil discovery in Colorado County, and 5 dry holes, 1 each in Chambers, Fort Bend, Lavaca, Liberty, and Matagorda counties.

SUCCESSFUL WILDCATS COMPLETED IN UPPER GULF COAST

Colorado County: New oil pool—Cities Service Oil Co. et al 1 John Schobal, James Tumlinson League, Columbus area, TD 9,752 ft., top of sand 7,820 ft., perf. 12 holes 7,857-59 ft., PT 124 bbl. per day through ¼-in. choke, gas-oil ratio 11,000 to 1, TP 1,300 lb., CP 1,075 lb., gravity 36°, no water.

WILDCAT FAILURES COMPLETED IN UPPER GULF COAST

Chambers County: Sun Oil Co. 2 Moore Estate, T&NO Sur. 23, Abst. 261, 5½ miles northwest of Winnie, dry at 9,132 ft.

Fort Bend County: H. E. Williams 1 Ma-

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rion I. Mellon et al, Edward Robinson Sur., 3 miles northwest of Lochridge field, dry at 6,325 ft.

Lavaca County: Seaboard Oil Co. of Delaware 1 E. Sebastian, Jas Lyons Sur., 2 miles northeast of Breslau, dry at 8,517 ft.

Liberty County: Shell Oil Co., Inc. 1 J. H. Weaver, Thos. Devers Sur., Abst. 170, 3 miles south of Cleveland townsite, dry at 6,058 ft.

Matagorda County: Atlantic Refining Co. 1 Craig Estate, Thos. Williams Sur., Abst. 107, Hawkinsville area, ¾ mile northeast of Cedar Lake Creek, dry at 4,126 ft.

CALIFORNIA

Limits of Cymric Field Extended by Standard

LOS ANGELES.— Standard Oil Co. of California extended productive limits of the Cymric field of Kern County this week by completing two excellent flowing wells in the Anderson sand found by Union Oil Co. in July. Four flowing wells have been finished to date, two by Standard and two by Union. The oil is of a light refinable grade and the reservoir shows a favorable gas-oil ratio. The Cymric structure, which appears to be an eastward plunging anticlinal nose which may be abruptly terminated in the west by faulting, will probably be relatively narrow across the axis. In the discovery well, 45-26 Anderson, Union topped the pay at 2,865 ft. subsea level as compared with Standard's 44-26 Weston which cored top of the oil sand at 2,824 ft.

Standard's 34-26 Weston, the most westerly completion, logged top of the Anderson sand at 2,698 ft. below sea level and has also cored the greatest thickness of oil sand, 130 ft. Union's second completion, the most easterly well in the field, found top of the Anderson sand at 2,810 ft. subsea level. Union's wells have elevations of 715 and 705 ft., and Standard's wells have elevations of 969 ft. and 702 ft. respectively.

Standard's 44-26 Weston is located 330 ft. north and 330 ft. west from the center of Section 26-29s-21e and Standard's 34-26 Weston is located 330 ft. north and 990 ft. west of the center of the same section. Union's 45-26 Anderson is located 330 ft. south and 330 ft. west from the center of Section 26-29s-21e, and the company's 55-26 Anderson is located 330 ft. south and 380 ft. east of the center of the same section. This pattern reveals the fact that Standard's 44 Weston and Union's 45-26 Anderson are north-south offsets with Standard's 34 Weston to the west and Union's 55-26 Anderson to the east.

Shell Oil Co., Inc., completed a good flowing well in the Ventura Avenue field when 44 Edison was finished producing 1,020 bbl. daily through 13/64-in. bean from 12,112 ft. The bit was still in Pliocene sediments when drilling operations were concluded in the D-7 zone. The deepest well at Ventura Avenue in measured depth is 3 Hartman of Alliance Petroleum Co. at 12,558 ft. in the D-7 zone. Stratigraphically there is not much difference as the subsea-level depth of 3 Hartman is 12,013 ft. and 11,958 ft. for Shell's 44 Edison. Shell's deep test at Long Beach in Los Angeles Basin is down 13,946 ft. in sand and shale. This is the deepest well ever drilled at Long Beach.

CALIFORNIA WILDCAT FAILURE

Imperial County, Brawley: Amerada Petroleum Corp. 1 Veysey, 9-13s-14e, bottomed in hard impervious gray sand, only minor showings, TD 8,350 ft.

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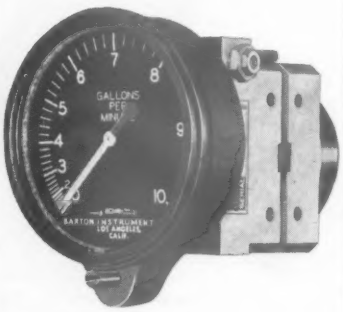

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CANADIAN FIELDS

Southern Alberta Will Probably Have New Pool

CHATHAM.—A new potential oil field in southern Alberta is indicated on the Hay Lake structure, just north of the Montana boundary and 9 miles west of the international town of Coutts-Sweetgrass, where Admiral-British Dominion 1, LSD 7, 22-1-17w4, got the Madison limestone at 3,087 ft. with porosity at 3,092-3 ft. A drill-stem test gave 330 ft. fluid in 1 hour, with 300 ft. oil and 30 ft. drilling fluid, and no indication of formation water. Oil influx is rated around 100 bbl. daily. Production string has been run for a definite test. Location is north and west of the abandoned Red Coulee field, but production comes from a lower horizon.

Conrad.—In the Conrad field, southern Alberta, Conrad-Province 75-33-B, LSD 12, 33-5-15w4, finished in the Ellis at 3,077 ft., drill-stem test indicating 100 to 130 bbl. The Ellis sand pool now has 16 producers, 14 by California-Standard and 2 by Mid-Continent-East Crest.

California-Standard after two unsuccessful tests is spudding Wrentham-Province 3 in LSD 13, 13-6-17w4, testing a potential extension of the Conrad field 8 miles to the west.

Steveville.—In the Steveville-Princess field, eastern Alberta, Princess-C.P.R. 18-22-A, LSD 16, 22-20-12w4, is testing at 3,952-61 ft. with good indications. Princess-C.P.R. 16-22-A, LSD 9, 22-20-12w4, after getting gas in the Devonian limestone is coring below 4,180 ft. for oil. One well is drilling and one starting.

Taber.—In the Taber field, southern Alberta, Taber-Province 47-15-A, LSD 15, 15-9-17w4, finished at 3,185 ft., is estimated around 75 bbl. Commonwealth-Taber 1, LSD 11, 22-9-17w4, finished at 3,217 ft., is being put on the pump.

Rusylvia.—In the Rusylvia area, north and west of the Vermilion field, Iscris M. 2, LSD 14, 36-53-6w4, has cemented at 2,141 ft., preparatory to testing.

EASTERN TEXAS

Humble Drilling Below 10,995 Ft. in Shelby

DALLAS.—M. E. Davis 1 Pickering, W. J. Brittain Survey, wildcat 6 miles southeast of Patroon, Shelby County, flowed 4 bbl. of fluid in 1 hour through 3/16-in. tubing choke, 65 per cent salt water and 35 per cent oil and gas-cut mud, through perforations from 5,780-95 ft. in the Hill zone of the Rodessa. Oil was estimated to be 32° gravity. Humble Oil & Refining Co. I Pickering, S. Francois Survey, in the Huxley area of eastern Shelby County, was drilling below 10,995 ft. in the Cotton Valley.

The Texas Co. 1 Ham, R. Lawson Survey, wildcat 4 miles southeast of Teague, Freestone County, flowed 1,500,000 cu. ft. of gas in 24 hours on a test through perforations from 8,002-18 ft. Total depth is 8,541 ft. Operator is still testing. Two miles southeast of Wortham, Freestone County, Blackwell Oil & Gas Co. has staked 1 Wasson (J. L. Bays), a Woodbine test, in the Sarah McAnulty Survey.

Phillips Petroleum Co. 1 Craver, Long Survey, east offset to the discovery in the South Tyler pool of southern Smith County, was squeezing perforations from 9,922-26 ft. after recovering a small amount of salt water and gas and was preparing to perforate in the section. Total depth is 9,999 ft. Magnolia Petro-

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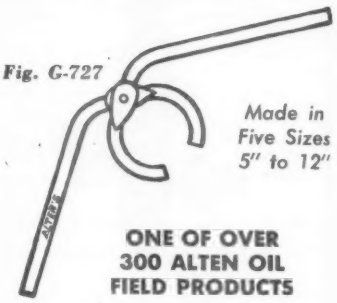

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leum Co. 1 Harrell, Wm. Wray Survey, wildcat 2½ miles southeast of Waterman, Nacogdoches County, cut core from 6,730-35 ft. and recovered a slight porous lime with odor and stain of oil. On a 30-minute drill-stem test from 6,725-35 ft. recovery was 1,000-ft. water cushion with 100 ft. of muddy salt water with an oil show. It was drilling below 7,363 ft. in lime and shale.

Carthage field, Panola County, had three completions this week. Wood County reported three new field locations, one each in Hawkins, Merigale and Quitman fields.

EASTERN TEXAS WILDCAT FAILURES

Bowie County: Northern Ordnance 1 J. L. Lumpkin, E. F. Edwards Sur., 3 mi. SW Dalby Springs, elev. 291 ft., Paluxy 5,920 ft., Glenrose 5,800 ft., Travis Peak 6,430 ft., dry, TD 7,021 ft.

Franklin County: Placid Oil et al 1 E. Ramsay, A. Stroud Sur. A-420, 2½ mi. SE Mt. Vernon, elev. 507 ft., Glenrose 5,540 ft., Travis Peak 7,235 ft., Cotton Valley 8,740 ft., dry, TD 9,164 ft.

Hopkins County: Magnolia 1 Fred Beville, Hayden Arnold Sur., 3 mi. NE Yantis, elev. 467 ft., Hill 8,002 ft., Young 8,362 ft., Pittsburg 8,565 ft., dry, TD 8,709 ft.

Panola County: Mae Belcher 1 Hudman, Elizabeth White Sur., 20 mi. SW Carthage, dry, TD 7,078 ft.

ROCKY MOUNTAIN

Rangely Field Has Important Developments

DENVER.—The Rangely field in Rio Blanco, Colo., has a number of important developments. Five wells with an aggregate initial production of 1,761 bbl. per day were completed; Utah Oil Refining Co. began running oil in its new pipe line to Wamsutter, Wyo.; the Department of the Interior restored to entry for mineral exploration more than 1,350,000 acres of public domain in the general area of the field; three new operations were started, and a test of the Morrison said is to get under way soon.

The best completion, and probably the largest well in the field, was California Co. 11 fee, SW SE 28-2n-102w, on the east side, which was drilled to 6,368 ft. and made 507 bbl. natural first 24 hours without being shot, through a ¼-in. choke, from the Weber sand. Stanolind Oil & Gas Co.'s 1 Lacy, a completion last week, made 542 bbl. through ¼-in. choke, but was shot. The other four were average wells.

Utah Oil Refining Co. began filling its new 150-mile 10-in. pipe line from Rangely to Wamsutter, Wyo., where it connects with the trunk line into Utah, on September 19. It will have a capacity of 20,000 bbl. per day and it will require 80,000 bbl. to fill the pipe. Extensive gathering lines are being laid throughout the field.

The 1,350,000 acres of public domain restored to leasing privileges by the Department of the Interior lies along the Colorado-Utah border, most of it being in Utah. It was withdrawn 12 years ago in connection with the passage of the Taylor Grazing Act and as the grazing districts have now been completed, the order has become obsolete. It will now be available for oil and gas development. The legal description of the areas is given in the Federal Register.

Divide Creek below 11,883 ft.—Superior Oil Co. 1 Miller, SW SW NW 36-8s-91w, Divide Creek, Mesa County, Colorado, record well for depth in the Rocky Mountain area, is drilling below 11,883 ft., having topped the Entrada sand at 11,820 ft., finding it hard and tight.

New operations.—Eleven new operations were reported, five in Colorado, two in Wyoming, and four in Montana. Four of

(Continued on page 172)

OHIO, KENTUCKY

North End of Sandyville Extended to West

COLUMBUS.—Wm. Pfeiffer 1 Geo. Wade Heirs, Section 33, Perry Township, Stark County, extends the north end of the Sandyville field ¾ mile west; 336,000 cu. ft. was found in the bottom Clinton at 4,312-39 ft. and after shot was shut in at 1,250,000 cu. ft. In the northeast part of the field, Frank Lyons finished a long fishing job on 1 First Savings Bank and found two pays in the Clinton at 4,678-734 ft. The well gaged 300,000 cu. ft. natural, and shut in at 724,000 cu. ft. after shot.

Ohio Oil Co. found only a show of gas in its test on W. O. Foster, Section 24, Franklin Township, Wayne County, and is drilling deeper. Clinton sand was logged at 3,653-77 ft. and 3,690-717 ft.

Twenty locations were reported for the week with Ashland-Lorain and Cambridge fields each having five. Of the 28 completions, Ashland-Lorain led with 7.

WILDCAT FAILURES COMPLETED IN OHIO

Athens County, York Township: Ohio Fuel Gas Co. 260 Sunday Creek Coal, Fr. 26, Clinton 3,542-72 ft., dry, TD 3,704 ft.

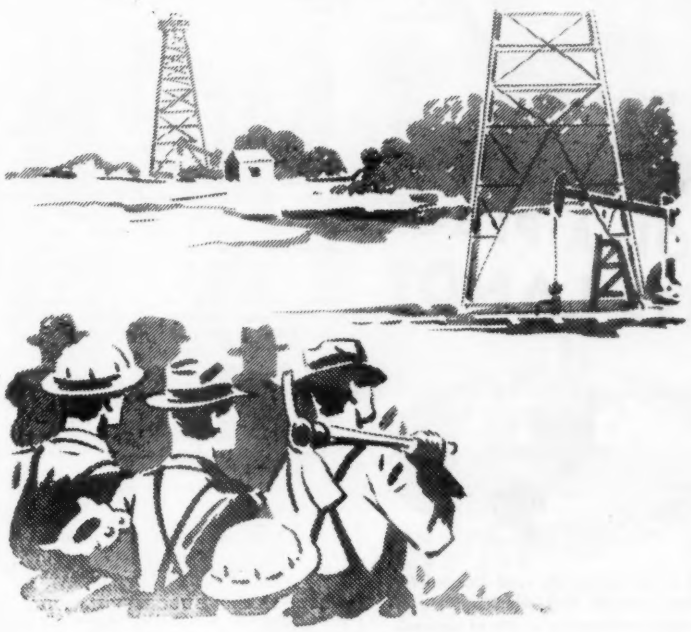
Medina County, Litchfield Township: Hanley & Bird 1 Chas. Motznik, Lot 2, Clinton, no sand, TD 2,848 ft.

EASTERN KENTUCKY

ASHLAND.—Knott and Johnson counties came in for completions this week, with a well in each county.

Kentucky-West Virginia Gas Co. completed 794 on the Clay Martin property

(Continued on page 172)



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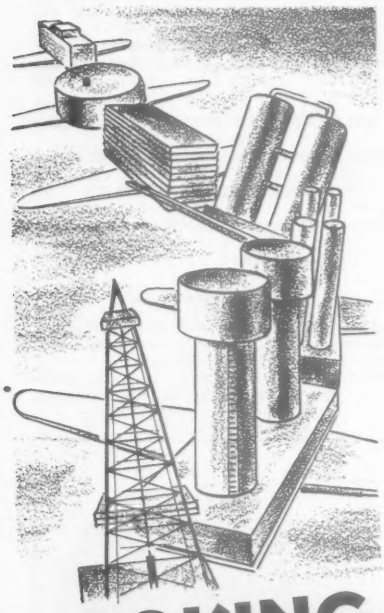

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THE CHAMBER OF COMMERCE OF WICHITA, KANSAS

PERMIAN BASIN

New Devonian Discovery Farthest North to Date

MIDLAND.—Amerada Petroleum Corp. 1-A Dr. E. H. Jones, Section 3, Block A-6, Public School Land Survey, Gaines County, opens the most northerly Devonian lime field in the Permian Basin. The wildcat is 4½ miles southwest of the Wasson field and 7 miles northwest of the Russell field. On the last test of the Devonian, the well flowed 499.66 bbl. of 42.7° gravity oil in 8 hours. The test was from 11,380-420 ft. The Devonian was entered at 11,181 ft., 7,482 ft. below sea level. Commercial production was also indicated in the Wolfcamp on drill-stem tests from 9,082-9,224 ft. Operator will continue to test.

Atlantic Refining Co. 1-A University, Section 33, Block 31, University Lands, opener of a Devonian oil pool in east central Crane County, 6 miles west of the north end of the McElroy pool, showed possibilities of production in the Ellenburger on a drill-stem test from 10,323-377 ft. There was a steady blow of air throughout the test. Recovery was 5,000 ft. of water cushion, cut with oil, estimated to be 20 per cent oil, and 800 ft. of oil cut with gas and drilling mud. Top of Ellenburger was called at 10,238 ft.

Ector County.—Shell Oil Co., Inc., and Cities Service Oil Co. 1-F TXL, Section 7, Block 45, T-1-S, T&P Survey, in the northwest part of the TXL pool, ran a 90-minute drill-stem test in the San Andres from 4,242-393 ft. and recovered 450 ft. of slightly oil and gas-cut drilling mud with 1 gal. of free oil on top. It was drilling below 4,573 ft. The Texas Co. 1-D Fraser, Section 27, Block 45, T-1-S, T&P Survey, east outpost to the TXL pool, had a small showing of oil in the Devonian. On a 1-hour drill-stem test from 8,505-41 ft. recovery was 80 ft. of oil and gas-cut drilling mud. It will be drilled deeper.

Fullerton field, Andrews County, had six completions this week while Keystone-Ellenburger, Winkler County, had three. Garza field, Garza County, reported six new locations, Shafter Lake field, Andrews, four, and Fullerton 8,500-ft. field, McElroy field, Crane County, North Ward Estes field, Ward County, each had two.

WEST TEXAS SUCCESSFUL WILDCAT

Pecos County: Extension to old oil pool—Texas 1 W. A. Martin, Sec. 14, Blk. 146, T&St.L Sur., 2 mi. SE Ft. Stockton pool, elev. 2,934 ft., flowed 52 bbl. day through 7/64-in. choke on 2-in. tubing, perf. 2,873-2,955 ft. Yates, gravity 29.6°, gas-oil ratio 1,817, TD 2,955 ft.

WEST TEXAS WILDCAT FAILURES

Irion County: Skelly 1 Sugg est., Sec. 45, Blk. 1, H&TC Sur., 7½ mi. NW Irion pool, elev. 2,485 ft., Detrital 7,920 ft., Ellenburger 7,936 ft., dry, TD 8,700 ft.

Pecos County: Lion Oil 1 H. J. Eaton et al, Sec. 542, Blk. 13, H&GN Sur., 6 mi. W. Ft. Stockton, elev. 3,057 ft., Yates 3,020 ft., dry, TD 3,356 ft.

Val Verde County: J. A. Green 1 John Ingram, Sec. 73, Blk. S-2, ELRR Sur. No. 1817, elev. 1,557 ft., dry in Pennsylvanian, TD 2,055 ft.

SOUTHEASTERN NEW MEXICO

HOBBS.—Humble Oil & Refining Co. 1-B Federal-Leonard, ½ mile north outpost to 1 Federal-Leonard, Ellenburger discovery in southeastern Lea County, had a slight show of oil at 3,690 ft. It was drilling below 3,948 ft. in lime. Humble has staked an 8,000-ft. test directly south of Neville G. Penrose, Inc.

(Continued on page 172)

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Use the power of steam, air or water under pressure to lift liquids. Being simple jet pumps they have no moving parts and require no lubrication. A variety of models to meet different conditions. Also used as water heaters.

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HOUSTON U·S·A TEXAS

KANSAS

Phil Han Opening New Pool in Rooks County

PHIL HAN 1 McClellan, NW NW SW 9-9-19w, a wildcat two miles west of the Barry pool of Rooks County, is swabbing 12 bbl. oil per hour from the Lansing. Conglomerate was cut at 3,510 ft., and Arbuckle at 3,519 ft. After running casing, perforations were made in the Lansing, and resulted in a 3,000-ft. fill-up in 17 hours. Operators then started swabbing.

One mile west of the new discovery Sharon Drilling Co. 1 Crowthers "A," the Sharon Drilling Co. 1 Rasmussen, NW NW NW 23-18-1w, has set pipe to test. The well is running lower than the discovery well, but a show of free oil was logged in the Mississippi chert at 2,809-12 ft. The Mississippi lime was topped at 2,784 ft., and the chert at 2,803 ft.

Completions this week totaled 43, with 23 oil wells, 6 gas wells, and 14 dry holes, including 5 wildcat tries. The only successful wildcat completed was the Darby and Bothwell 1 Cromb, discovery well in Ellis County. New locations balanced completions, with 43 being announced. Six wildcats are scheduled to start, one each for Barber, Cowley, Phillips, Rooks, Russell, and Sumner counties.

KANSAS SUCCESSFUL WILDCAT

Ellis County: New oil pool.—Darby & Bothwell 1 Cromb, NE NW NW 22-11-20w, physical potential 190 bbl. from Lansing at 3,467-71 ft., TD 3,710 ft., Kansas City 3,374 ft., Simpson 3,669 ft., Arbuckle 3,680 ft.

KANSAS WILDCAT FAILURES

Greenwood County: K. T. Weideman 1 Riggs, NW SW NE 25-27-10e, dry, TD 2,083 ft., Mississippi lime 1,988 ft.

Haskell County: Carter 1 Dietz, 50 ft. west of center of 6-29-31w, dry, TD 2,922 ft., Fort Riley 2,818 ft.

Pawnee County: Huber & Kiowa 1 Singer, NW NW SE 5-20-17w, dry, TD 4,002 ft., Arbuckle 3,962 ft.

Phillips County: Stanolind 1 Willtrout, SW SW SW 35-4-20w, dry, TD 3,396 ft., Arbuckle 3,384 ft.

Sumner County: Fidelity Royalty 1 Carson, SW NW SW 12-35-1e, dry, TD 3,735 ft., Wilcox 3,726 ft.

MICHIGAN

Possibility Seen of New Field in Montcalm

SAGINAW. — After a week of drilling activity bringing 11 dry holes out of 14 completions, 8 being wildcat tests, Michigan operators looked to possibility of a new field in Douglas Township, Montcalm County. Leslie T. Barber and Associates reported a "good well" on the Guyger lease, 5 miles southwest of Edmore, 6 miles southwest of the Home Township pool discovered 8 years ago. Barber released no production figures but said the oil is in the Dundee at 3,396 ft. Leases in the vicinity were reported bringing up to $75 an acre.

Eleven new locations were announced during the otherwise dull week as the three new producers, two in Isabella, one in Bay County, totaled only 145 bbl. initial. Two tests are set for Van Buren County, two for Missauke, one each for Barry, Allegan, Washtenaw, Kalamazoo, Osceola and Muskegon.

Backed by leading operators, the state conservation department has decided to retain in general the wartime 40-acre drilling pattern. In some cases 20-acre spacing will be permitted. Conservation is the reason. In a partial answer to sportsmen's protests, the commission last week promised it will not lease submerged lands near Saginaw Bay and Great Lakes shores for drilling purposes.

MICHIGAN WILDCAT COMPLETIONS

Alcona County, Gustin Township: P. R. Donahoe 1 Manly Burton, NW NW SW 34-26n-8e, dry in Dundee, TD 1,990 ft.

Allegan County, Allegan Township: Harris Oil Co.-Del Fortney 1 Roland Miller, NW SW NW 2-2n-13w, dry in Traverse limestone, TD 1,582 ft.

Casco Township: Eric Bock 1 Nina L. Irey, NW NW SE 22-1n-16w, dry in Dundee, TD 1,160 ft.

Monterey Township: R. B. Tamblyn Development Co. 1 D. F. Spray, C E½ NW NE 3 frl-3n-13w, dry in Traverse limestone, TD 1,742 ft.

Alpena County, Ossineke Township: Sohio Petroleum Co. 1 Turtle Lake Club, SE NW NE 9-29n-5e, dry in Sylvania, TD 2,660 ft.

Kalamazoo County, Portage Township: Vanco Oil & Gas Co. 1 John P. DeRight, NE NE NW 13-3s-11w, dry in Traverse limestone, TD 1,294 ft.

Kent County, Courtland Township: Byron MacCullum, Tr., 1 John O. Planck, SW SW NE 31-9n-10w, dry in Traverse limestone, TD 2,360 ft.

Van Buren County, Columbia Township: Del Fortney 1 J. F. and M. L. Eddy, SW NE NW 1-1s-15w, dry in Traverse limestone, TD 1,176 ft.

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Fig. D312

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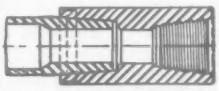
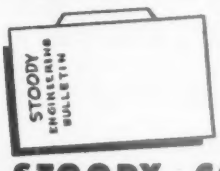
APPLICATION: Accepted method of application is to under-cut new or resleeved joints at the shoulder to form a recess ⅛" deep by 1½" wide. The recess is then filled by welding in with 3/16" Electric Tube Borium to form the wear resistant inlay.





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SOUTHWEST TEXAS

Hysaw Field Is New Oil Discovery

CORPUS CHRISTI.—The Hysaw field is new oil discovery 7 miles west of Karnes City, opened by Seaboard Oil Co. of Delaware at its 1-A E. N. Hysaw, in Karnes County, Don Erasmo Seguin Survey. This well flowed a potential of 102 bbl. per day through a ⅛-in. choke, tubing pressure 450 lb., casing pressure 950 lb., no water. Gas-oil ratio is 196 to 1. Total depth is 3,982 ft., with 5½-in. casing set on bottom. Production is through perforations at 3,973-76 ft.

A new gas pool, 4½ miles southwest of Carrizo Springs, in Dimmit County, has been opened by Calatexia Oil Co. 1 S. E. McKnight. Drilled to a total depth of 2,995 ft., the 5½-in. casing was perforated with 36 holes at 2,638-45 ft., and well gaged estimated 1,300,000 cu. ft. of gas per day on open flow. On a ⅛-in. choke it flowed 295,800 cu. ft. of gas per day, 835 lb. pressure. The 5½-in. casing was set at 2,757 ft.

Rowan & Hope 3 Sally Ragsdale opened a new gas pool in Victoria County, 10 miles east of Telferner in Jas. McConnaughey Survey, Abstract 262. Drilled to a total depth of 4,453 ft., test was completed as a gas well, no gage, through perforations at 4,443-52 ft.

Tom Graham 1 Theis et al, wildcat, 16 miles northwest of Beeville in Bee County, R. S. Barnes Survey, Abstract 115, after recovering oil on drill-stem test at 3,565-87 ft. operators set 7-in. casing at 3,571 ft. and are preparing to test sand at 3,571-79 ft. Total depth of this well is 3,587 ft.

Slick Oil Co. 1 R. R. Mullen, wildcat, 3 miles south of Alice, in J. Poitevent Survey 207, Jim Wells County, recovered oil-cut mud and salt water on two drill-stem tests at 4,510-20 ft. All perforations were squeezed and operators are now testing through new perforations at 4,494-4,502 ft.

There were 27 new locations reported this week, 10 being wildcats, 1 each in Atascosa, Bastrop, Goliad, McMullen, Medina, Milam, Nueces, Starr, Victoria, and Williamson counties. Of the 32 completions 15 were wildcats, 3 new field discoveries, 1 each in Dimmit, Karnes and Victoria counties, and 12 dry holes. Duval and Victoria counties led in completions with four each.

SUCCESSFUL WILDCATS COMPLETED IN SOUTHWEST TEXAS

Dimmit County: New gas pool—Calatexia Oil Co. 1 S. E. McKnight, Sec. 35, Blk. 13, 4½ miles southwest of Carrizo Springs, top sand 2,638 ft., TD 2,995 ft., perf. 36 holes, 2,638-45 ft., PT estimated 1,300,000 cu. ft. gas per day, open flow, rock pressure 1,040 lb., no water.

Karnes County: New oil pool, Hysaw—Seaboard Oil Co. of Delaware 1-A E. A. Hysaw, Don Erasmo Seguin Sur., Abst. 10, 7 miles west of Karnes City and 2 miles southwest of Hobson field, TD 3,982 ft., perf. 3,973-76 ft., PT 102 bbl. per day through a ⅛-in. choke, gas-oil ratio 196 to 1, TP 450 lb., CP 950 lb., no water.

Victoria County: New gas pool—Rowan & Hope 3 Sally Ragsdale, Jas. McConnaughey Sur., Abst. 262, 10 miles east of Telferner, TD 4,453 ft., perf. 47 holes 4,443-52 ft., PT gas well, no gage, TP 1,785 lb., CP 1,800 lb., through ⅛-in. choke.

WILDCAT FAILURES COMPLETED IN SOUTHWEST TEXAS

Bee County: Ashland Oil & Refining Co. 1 Mary Zowarka et al, Bee County School Land Sur. 16, Abst. 102, 6 mi. west of Skidmore, dry at 4,421 ft.

Bridwell Oil Co. 1 J. W. Dryden estate, Jas. Hefferman Sur., 2 miles northeast of Beeville, dry at 4,018 ft.

Brooks County: Ralph E. Fair, Inc. 1 Jose Garcia, L. A. Mestena Grant, Sec. A-1, 1½ miles northeast of Alta Mesa field, dry at 6,350 ft.

Duval County: J. W. Kunetka 1 Wm. A. Tinney, A. J. Bryant Sur., Sec. 8, 2 miles northeast of Benavides, dry at 767 ft.

Karnes County: Southern Minerals Corp. 1 W. D. and O. L. Cochran, D. B. McConnall Sur., Abst. 191, 4½ miles northeast of Gillett, dry at 6,110 ft.

Kleberg County: Lonnie Glasscock 1 Paul O. Henry, KT&I Subd., Lots 3, 4, and 6, Section 49, 8 mi. southeast of Kingsville, 1½ mi. southeast of Ricardo field, dry at 7,563 ft.

McMullen County: Midstates Oil Corp. 1 Nueces Land & Livestock Co., Jacob Matossy Sur. 86, Abst. 306, 10 miles west of Loma Alta field, dry at 1,606 ft.

Quintana Petroleum Corp. 1 Ethel Lowe Craig, J. Poitevent Sur., Sec. 17, Abst. 366, 3 mi. southeast of Fowlerton, dry at 5,798 ft.

Quintana Petroleum Corp. 7-F South Texas Syndicate, J. S. Clift Sur. 489, 10 mi. south of Fowlerton, dry at 6,642 ft.

Nueces County: H. R. Smith and H. J. Mosser 1 Mrs. Agnes Gescheidle, Casa Blanca Grant, O. B. Oliver Tract, 7 mi. north of Agua Dulce, dry at 6,209 ft.

Victoria County: Monday Oil Co. et al 1 Mary F. Miller, SA&MG Sur., Abst. 381, 10 miles southeast of De Costa, dry at 6,808 ft.

Production Service Co. 1 Laura Adams, Allen Talbot Sur., Abst. 336, 8 miles south of Victoria, dry at 5,212 ft.

LA.-ARK.

Three New Wells Drilling in McDonald

MAGNOLIA.—The new McDonald field of Ouachita County, discovered recently by McAlester Fuel Co. 1 Wesson, NE NE SW 24-15s-19w, is being developed rapidly. Three wells are now drilling in the area. G. H. Vaughn, Jr., is drilling 1 and 2 Turner, in Section 27-15s-18w. No. 1 is bailing at a total depth of 4,005 ft., and No. 2 is drilling below 2,473 ft. G. H. Vaughn 2 Haltom is a location in NW NE SW 28-15s-18w.

In Union County, Robert C. Wallingsford 1 Duke, SW NE NW 13-18s-13w, is arranging to pump after having 420 ft. of oil rise in the hole. The well tested one bbl. oil per day before deepening to 2,305 ft., where the fill-up occurred.

Arkansas had three completions this week, two field oilers, and the formal completion of the Ouachita County discovery. New locations totaled four, including one wildcat to be drilled in Union County. In North Louisiana, 14 wells were completed, 9 oilers, 1 gas well, and 4 dry holes, of which 1 was a wildcat try. Nineteen locations were announced this week, including four wildcats, which are scheduled one each for DeSoto, Franklin, Lincoln and Richland parishes.

ARKANSAS SUCCESSFUL WILDCAT

Ouachita County: New oil pool.—McAlester Fuel 1 Wesson, NE NE SW 24-15s-19w, 96 bbl. from Glen Rose at 2,648-80 ft., TD 2,954 ft.

NORTH LOUISIANA WILDCAT FAILURE

Richland Parish: H. W. Todd et al 1 Greer est., 440 ft. north and 660 ft. east of SW cor. NE SW 13-16n-7e, dry, TD 3,399 ft.

N. CENTRAL TEXAS

Stine Producer Reported Largest in Clay County

WICHITA FALLS.—A. R. Dillard 1 Dr. J. T. Lawson, N. Kimbro Survey, wildcat in central Montague County, drilled saturated conglomerate from 6,001-12 ft. in the Bend. On a drill-stem test from 6,001-12 ft. gas came to the surface in 2 minutes. The well flowed oil for 29 minutes. Bottom-hole pressure was 2,900 lb. It was drilling below 6,107 ft. in shale.

Clay County.—F. P. Collum 1-B Stine, Section 25, Block 4, H&TC Survey, Stine pool, is reported to be the largest producer in Clay County. It has been completed for 2,544 bbl. of 47.6° gravity oil in 24 hours. Production is from 5,606-12 ft. Continental Oil Co. 1 Slaton, G. F. Lawrence Survey, wildcat 5 miles southwest of Bellevue, is dry at 6,708 ft. after running electrical survey. In northern Clay, Fain & McGaha and Republic Natural Gas Co. will drill a 6,000-ft. wildcat 5 miles east of Henrietta. It is 1 Bryant Edwards in the S. C. Beldon Survey, Abstract 12.

Kerlyn Oil Co. and Phillips Petroleum Co. 1 Edwards, TE&L Survey, wildcat 5 miles north of Jean, drilled Mississippian showing oil from 5,106-13 ft., cleaned out, swabbed four times and blew in natural to flow 129 bbl. of 43° gravity oil in 5 hours. It has been shut in.

Wichita County had 10 field completions this week while Cooke County had 5 and Archer County 4. Wichita County reported 15 new field locations and Young County 4.

In West Central Texas, Jones County had four completions and the Reddin field, Taylor County, had three. Jones County had three field locations and the Reddin field had two.

NORTH CENTRAL TEXAS SUCCESSFUL WILDCATS

Archer County: New oil pool—Robertson Drilling 1 J. T. Richardson est., Lot 14, Jonathan Scott Sur. A-374, 5 mi. N and 3 mi. W Olney, elev. 1,173 ft., flowed 1,688 bbl. day through 12/64-in. choke, perf. 4,702-10 Caddo, gravity 40.5°, gas-oil ratio 300, TD 5,222 ft.

Clay County: New oil pool—W. H. Hammon et al 1 H. W. Bryans, Mary F. Sims Sur. A-972, 11 mi. NE Wichita Falls, elev. 952 ft., pumped 20 bbl. day, perf. 5,862-92 ft. Caddo, gravity 41°, gas-oil ratio 210, TD 6,503 ft.

NORTH CENTRAL TEXAS WILDCAT FAILURES

Clay County: Continental 1 E. M. Stallings, Sec. 3252, TE&L Sur., ½ mi. E Vashti,

(Continued on page 172)

OKLAHOMA

Flank Well in West Edmond Flows 2,946 Bbl. a Day

THE outstanding completion of the week in Oklahoma was a southeast flank well in the West Edmond pool in Oklahoma County. Two big gas wells in Stephens and Caddo counties were among the week's results. The old Wilzetta pool in Lincoln County was given new life by deepening to the Wilcox sand.

L. B. Jackson and Deep Rock Oil Co. 1 Rose, NW SE NE 26-11n-2e, recent pool opener in Pottawatomie County does not have sufficient gas to flow it, and will be put on the pump. The well produced 139 bbl. of oil and 44 bbl. of water on the swab from Wilcox sand at 5,803-12 ft., the total depth.

Ilco Corp. 2 Allred, SE NE NW 8-9n-7e, Cheyarha pool, Seminole County, flowed 250 bbl. in 24 hours through casing following a shot of 80 qt. at 3,535-63 ft.

Gulf Oil Corp. opened a gas field in Stephens County with 1 Briscoe, C SE NW 36-2n-8w. The well gaged at the rate of 78,500,000 cu. ft. of gas, also producing distillate, using various chokes which yielded from 1.77 bbl. to 7.17 bbl. per hour. The hole was drilled to 8,104 ft., but the pay was through perforations at 7,732-74 ft. Shut-in pressure was 2,985 lb. per square inch.

Down on the southeast flank of the West Edmond field in Oklahoma County, Cities Service Oil Co. 1 Stinchcomb-D, C NE SE 28-13n-4w, flowed 2,946 bbl. in 24 hours, through 1-in. choke, from the Bois D'Arc section of the Hunton lime topped at 6,851 ft., total depth 6,964 ft. The pay had been acidized.

The Texas Co. 1, in NE NE SE 8-1n-19w, Jackson County, a wildcat, total depth 2,976 ft., was plugged back to 1,886 ft. and casing perforated at 1,419-33 ft. The hole filled with 48-gravity crude. Owner was preparing to put it on the pump.

The Texas Co. 1 Wylie, SW SE SE 17-2n-8w, Stephens County, total depth 7,500 ft., was plugged back to 7,384 ft. and casing perforated with 160 shots at 4,978-5,020 ft. It flowed 118 bbl. in 24 hours through 3-/16-in. choke.

OKLAHOMA SUCCESSFUL WILDCAT

Stephens County: New oil pool.—Gulf 1 Briscoe estate, SE NW 36-2n-8w, flowed 1,319 bbl. condensate and 78,500,000 cu. ft. gas from Pennsylvanian sand at 7,732-74 ft., TD 8,104 ft.

OKLAHOMA WILDCAT FAILURES

Greer County: Stephens Petroleum 1 Johnson, SE SE NW 24-5n-21w, dry, TD 910 ft. in granite.

Hughes County: Four States 1 John, SW

(Continued on page 171)

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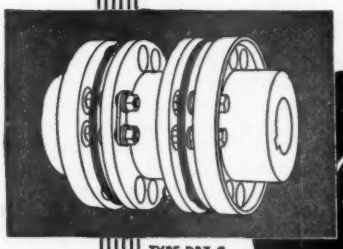

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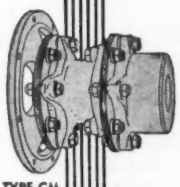

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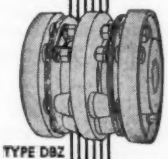

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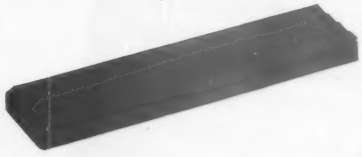

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Among the Drilling Contractors

Dewey Stinson, Troy, Ind., has the contract to drill the A. L. Stemler 11 J. A. and Ruth L. Stewart, in SE SE 28-6s-5w, Spencer County, Indiana.

Mercury Drilling Co. has the contract for Continental Oil Co.'s 2 S. F. Borden in E. S. Wilson Survey, Jack County, Texas. The 1 Borden, also drilled by Mercury, opened a new pool in Jack County.

George F. Gregory & Son of Petrolia, Ontario, have discontinued business as drilling contractors, owing to the illness of the senior member of the firm. In 16 years of contracting they have operated three Star outfits on oil and gas projects in many different parts of western Ontario, as well as the Rainy River and Manitoulin Island areas. Prior to entering the contracting business G. F. Gregory drilled in the Persia, Sumatra and South American fields.

Fowler Drilling Co., California drilling contractor, will drill a second well at Huntington Beach for George C. Atha. The first well, drilled on the Newland property at the southeast end of Huntington Beach, proved to be a gas well. Atha's next project will be located on the Surf Land & Water Co. property in 13-6s-11w, and an early spud will be made.

J. J. Fleet, Ada, Okla., has again entered the drilling contracting business, following release from the armed forces which he entered early in the war. He now has two rigs running for Ashland Oil & Refining Co. in 11-4n-7e, and 24-12n-5e, in Oklahoma, and expects to have a third rig within a couple of weeks, and two heavy outfits by the first of the year. Lee Minton, previously associated with Fleet, is drilling superintendent.

Sharon Drilling Co. has staked a new test for McPherson County, Kansas, at 1 Leasure, in SE SE NE 29-18-1w. Nearest production is in the Jenday pool 2 miles to the southwest.

Rine Drilling Co. is drilling the Lion Oil Co. 1 McMichael, new Kingman County, Kansas, wildcat, in SW SW NW 13-27-10w, which was drilling below 2,200 ft.

WEIGHT INDICATOR POINTS

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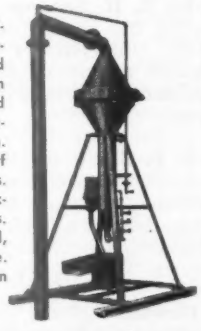

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MARKET QUOTATIONS

Prices as of September 25, 1945

(This service is abbreviated because most refinery products are selling at the Government's price ceilings. Quotations on other products than those shown here furnished on request. Quotations are f.o.b. plant in tank cars and in cents per gallon.)

REFINERY GASOLINE

Octane (A.S.T.M.)	76†	70-74
Mid-Continent*	6.75	6.000
Gulf Coast	6.75	5.750
Northeast Coast	...	9.875
California	...	6.50-7.00

*Basic Oklahoma Group 3. †1939 C.F.R. (research method).

NATURAL GASOLINE

Grades:	26-70	18-55
Oklahoma (Group 3)	4.500	5.400
North Texas (f.o.b. plant)	3.500	4.200
North Louisiana (f.o.b. plant)	3.750	4.500
California	4.875	5.500

CRUDE-OIL PRICES

Representative posted schedules per bbl.	
East Texas	$1.25
Conroe	1.49
Tepetate, Louisiana, avg. grav.	1.20
Illinois Basin	1.37
Pecos County, Texas	.95
Bradford, Pennsylvania	3.00
Van, Van Zandt County, Texas	1.01

Note: Exclusive of subsidy.

GRAVITY SCHEDULES

Top prices include all gravities above grades designated, and low prices include all gravities below grades designated:

Gravity—	Signal Hill, Calif.	Oklahoma Kansas	Gulf Coast Texas	West Tex.*
18-18.9	$0.80	....	....	....
19-19.9	.84	....	$1.06	$0.70
20-20.9	.88	$0.85	1.08	.72
21-21.9	.92	.87	1.10	.74
22-22.9	.96	.89	1.12	.76
23-23.9	1.00	.91	1.14	.78
24-24.9	1.03	.93	1.16	.80
25-25.9	1.07	.95	1.18	.82
26-26.9	1.11	.97	1.20	.84
27-27.9	1.15	.99	1.22	.86
28-28.9	1.18	1.01	1.24	.88
29-29.9	1.20	1.03	1.26	.90
30-30.9	1.23	1.05	1.28	.92
31-31.9	....	1.07	1.30	.94
32-32.9	....	1.09	1.32	.96
33-33.9	....	1.11	1.34	.98
34-34.9	....	1.13	1.36	1.00
35-35.9	....	1.15	1.38	1.02
36-36.9	....	1.17	1.40	1.04
37-37.9	....	1.19	1.42	1.06
38-38.9	....	1.21	1.44	1.08
39-39.9	....	1.23	1.46	1.10
40 and above	....	1.25	1.48	1.12

*Includes Lea County, New Mexico.

A.P.I. REFINERY REPORT

Week ended September 15, 1945
(Figures in thousands of barrels)

	Dly. crude runs to stills	Stocks: Gasoline	Stocks: Distillate	Stocks: Residual
East Coast	702	15,106	14,205	9,093
Appalachian	148	3,958	1,089	523
Ill., Ind., Ky.	758	17,667	5,953	3,323
Okla., Kan., Mo.	382	7,192	2,746	1,287
Inland Texas	221	2,673	448	1,047
Tex. Gulf Coast	1,101	16,243	5,416	5,581
La. Gulf Coast	260	4,293	2,030	1,139
North La., Ark.	86	2,747	605	218
Rocky Mtn.	127	1,797	482	749
California	831	13,533	10,533	25,510
Total 9-15-45	4,616	*85,209	43,507	48,470
Total 9- 8-45	4,640	85,230	42,189	47,871
Total 9-16-44	4,634	77,369	42,082	52,243

*Military 35,104; civilian 50,105.

CRUDE-OIL STOCKS

(Bureau of Mines Estimate)

Week ended:	Bbl. of crude*
September 15, 1945	214,480,000
September 8, 1945	213,721,000
September 16, 1944	221,989,000

*Excludes unrefinable California stocks.

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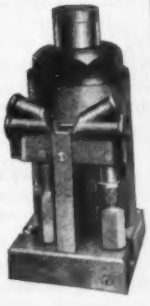

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PERSONALS

Mullane Assistant Chief Petroleum Engineer

DR. J. J. MULLANE, since 1943 reservoir engineer for The Carter Oil Co., has been appointed assistant chief petroleum engineer. He has been with Carter since his graduation from University of Chicago in 1938.

A native of Chicago, Dr. Mullane entered University of Illinois in 1929. He received his bachelor of science degree in chemical engineering in 1933 and after 5 years' study at University of Chicago, earned his Ph.D. degree in 1938. He became research engineer at Carter's Tulsa laboratory in 1938 and remained in that capacity until 1943, when he was made reservoir engineer in the production department.

Dr. Mullane is active in petroleum organizational work and now is serving on the well-spacing and allocation of production, the core-analysis and electric-logging, and the production-technology committees of American Petroleum Institute.

Hubert Guyod, who recently resigned as research engineer for Halliburton Oil Well Cementing Co., has opened offices as a well-logging consultant in Houston, specializing in interpretation, designing equipment, and doing general research work.

John O. Larson, formerly in the coordination and economics department of Standard Oil Co. (New Jersey), has been appointed an assistant secretary. Larson, who has helped to prepare world-wide operating programs of Jersey affiliates, will be an assistant to **A. C. Minton,** secretary of the company, in New York.

Homer C. Moore, manager of the geological and geophysical department of Mid-Continent Petroleum Corp., has submitted his resignation, to be accepted when his successor is appointed. He plans to establish a consulting office in Tulsa.

Oliver B. Wendeln, for 5 years superintendent of Pure Oil Co.'s refinery at Mt. Pleasant, Mich., has been transferred to the Chicago office. He is succeeded by **H. L. Smith,** of Toledo, a veteran of Pure's refining division.

Norman J. Rogers, assistant resident manager of Ecuador Oilfields, Ltd., is on a business and vacation trip to the United States. He will leave shortly for California after having spent a month in New York. He will return to Guayaquil in October.

H. F. Sheets, chairman of Socony-Vacuum Oil Co., Inc., has been named a member of an advisory committee of eight well-known business men to review current methods of trade promotion and protection employed by the Foreign Trade Service of the United States, with a view of adapting them to new and changing conditions. Sheets represents the Chamber of Commerce of the United States.

Alexander Forward, who will retire October 1 after 22 years as managing director of American Gas Association, was the honor guest at a testimonial dinner given September 11 at the Waldorf-Astoria Hotel, New York, by the association's executive board.

John H. Murrell, junior partner in the firm of DeGolyer & MacNaughton, Dallas, gave an illustrated talk on "Production and Reserves of the Middle East" before the Oklahoma Geological Society September 26. Murrell accompanied **E. DeGolyer** and **W. E. Wrather,** director of U. S. Geological Survey, in a mission to the Middle East to study its oil and gas reserves for Petroleum Reserves Corp.

Maj. J. D. McCamey, who as safety engineer was granted a leave of absence from The Carter Oil Co. in November 1942 to enter military service, has returned and will assume new duties as assistant to the personnel manager. In Africa, McCamey was groundforce representative on a secretariat to the Petroleum Executive Committee of Tunisia, a joint British and United States coordinating agency. On formation of the Adriatic base depot group in 1943, to serve the U. S. Army Air Force operating in East Italy, McCamey was appointed base petroleum officer in that area. For meritorious services he was awarded the Legion of Merit.

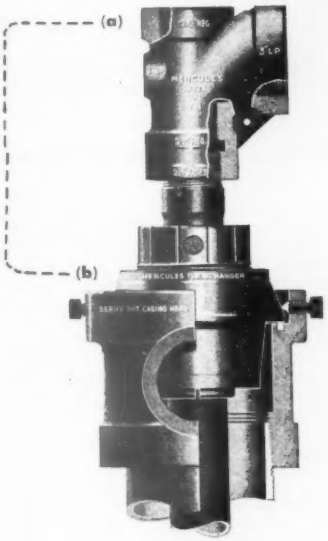
V. F. Fuson has opened an office in Fort Worth for Ashland Oil & Refining Co. Fuson opened a North Central Texas office at Wichita Falls for British-American in 1938, was transferred to the Illinois-Indiana area to open a district office in 1942, and returned to this area with Ashland.

Maj. Robert W. Harrison, released from active duty in the Corps of Engineers, U. S. Army, has joined the consulting firm of Boatright & Mitchell, in Houston, as a petroleum engineer.

Dr. E. H. Sellards, retiring director of the bureau of economic geology, University of Texas, was accorded a tribute in a resolution adopted by Dallas Petroleum Geologists.

J. P. Shaff, for 18 years in the sales and distribution department of Phillips Petroleum Co., Bartlesville, Okla., has been made sales manager of Sunray Oil Corp., with headquarters in Tulsa.

Howard C. Pyle, chief production engineer for Union Oil Co. of California before entering Army service, has been elected a vice president of Bank of America, Los Angeles, to take charge of the bank's new oil division. Pyle obtained leave from Union in January 1943 and served in both the United States and European theaters of war until his recent discharge.



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Oklahoma Fields

(Continued from page 167)

NE 24-9n-11e, dry, TD 3,558 ft., Cromwell 3,507 ft.

Pottawatomie County: F. Anderson and Good 1 Good, SE SW 3-11n-5e, dry, TD 4,921 ft., second Wilcox 4,892 ft.

Texas 1 Whitaker, SE SE NW 28-7n-3e, dry, TD 5,403 ft., second Wilcox 5,255 ft.

Seminole County: Manahan Oil 1 Gragg, SW SW NE 13-11n-7e, dry, TD 3,647 ft., Cromwell 3,629 ft.

ILLINOIS

Unusually Good Wells In Richland and Jefferson

MATTOON, Ill.—Twenty-eight oil wells with an average initial production of 159 bbl. per well, as against a January through August average of 141 bbl. per well, were completed in the past week in Illinois. Twenty-one dry holes were abandoned, including 11 wildcats. A 10-bbl. wildcat extended the Mt. Carmel pool in Wabash County.

The banner well of the week was Cooperative Refining Co. 1 M. Ede, NE SE NW 7-2n-10e, in the Calhoun pool, Richland County, which pumped and flowed 970 bbl. in 24 hours from acidized McClosky lime at 3,112-24 ft. Another unusually good well was W. Duncan 1 Waite, NE SE SW 23-1s-3e, in the Divide West pool in Jefferson County, good for 512 bbl. in 24 hours from acidized McClosky lime at 2,743-58 ft. and 2,771-75 ft., and a third big producer was Pure Oil Co. 12 L. A. Wassom, NW NE SE 27-4n-9e, in the North Noble pool in Richland County, which made an initial flow of 526 bbl. through 1-in. choke from acidized Rosiclaire lime at 2,937-39 ft. and McClosky lime at 2,951-56 ft.

Forty-nine new operations were reported, including 10 wildcats, scheduled three for Clinton County, four for Wayne County and one each for Effingham, Madison, and Hamilton counties.

SUCCESSFUL ILLINOIS WILDCAT

Wabash County: R. S. Hayes 1 Calverly, SW SW NW 19-1s-12w, McClosky lime at 2,398-2,403 ft., acidized, pumped 10 bbl. of oil and 100 bbl. of water in 24 hours. Total depth 2,442 ft. Extends Mt. Carmel pool.

ILLINOIS WILDCAT FAILURES

Clay County: J. J. Lynn 1 H. Bressenden, NE NW NW 22-3n-8e, dry at 3,090 ft. Menard 2,254 ft., Cypress 2,656 ft., Aux Vases 2,912 ft., McClosky 3,010 ft.

Coles County: William Cartmell et al J. T. Ewell, NE NE SE 32-12n-7e, dry at 2,302 ft. Menard 1,853 ft., Cypress 2,144 ft., Benoist 2,252 ft., Renault 2,292 ft.

Effingham County: W. W. Shaffer 1 H. Ripking, SW NW SE 14-7n-6e, dry at 2,706 ft. Menard 1,968 ft., Cypress 2,378 ft., Benoist 2,481 ft., Aux Vases 2,531 ft., McClosky 2,656 ft.

Gallatin County: Standard Drilling Co. 1 T. H. Boyd, NW NE NE 27-7n-9e, dry at 3,046 ft. Aux Vases sand 2,850 ft., Ste. Genevieve lime 2,909 ft. Hole plugged back to 2,298 ft. and sand at 2,291-98 ft. shot with 12 qt. Salt water and a small showing of oil resulted.

Jefferson County: Ryan Oil 1 J. G. Cockran, NW NE SW 19-4s-4e, dry at 3,257 ft. Lower Menard 2,265 ft., Barlow 2,740 ft., Cypress 2,766 ft., Aux Vases 3,020 ft., McClosky 3,160 ft.

Marion County: National Associated 1 Bryan, SE NW NE 9-3n-2e, dry at 2,301 ft. Menard 1,480 ft., Cypress 1,870

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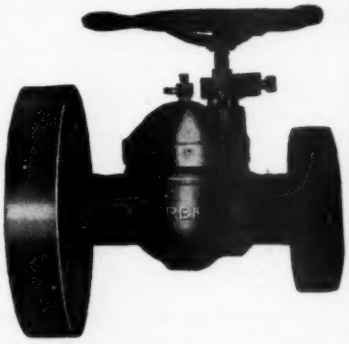

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ft., Benoist sand 2,030 ft., Aux Vases 2,113 ft., McClosky 2,208 ft.

Shelby County: Ollie Baugher 1-A Edwards, NW SE NE 26-12n-5e, dry at 860 ft. No log.

Wayne County: George, Schoonmaker 1 Berg, SE SW SW 22-1s-9e, dry at 3,463 ft. Menard 2,420 ft., Cypress 2,912 ft., Benoist 3,099 ft., Aux Vases 3,221 ft., McClosky 3,314 ft.

White County: National Associated 1 A. Dalby, SE SW NE 6-6s-8e, dry at 3,527 ft. Lower Kincaid 2,204 ft., Cypress 2,986 ft., Weiler 3,034 ft., Aux Vases 3,287 ft.

H. H. Weinert 1 McEwen, NW NW SE 3-6s-8e, dry at 3,463 ft. Upper Kincaid 2,209 ft., Cypress 3,007 ft., Benoist 3,154 ft., Aux Vases 3,286 ft., Lower O'Hara 3,372 ft.

John Carlson et al 1 Orr Fulkerson, SW SW NE 4-7s-9e, dry at 3,200 ft. Paint Creek 2,906 ft., Benoist 2,920 ft., Aux Vases 3,032 ft., Ste. Genevieve 3,062 ft., Fredonia 3,155 ft.

MISSISSIPPI

Hub Oil Producer Has Puzzling Aspects

JACKSON.—The oil well coming in at Marion County's Hub condensate field gives rise to speculation. Humble Oil & Refining Co. 1 Ball, 760 ft. south and 1,980 ft. east of the NW cor. 20-2n-14e, just 1 mile southwest of the discovery well, is producing 108 bbl. of 35.4-gravity oil from the Massive sand, perforated at 9,123-27 ft. A comparison of tops and elevation shows that the two wells are producing from essentially the same depth, having only 1 ft. difference in elevation, but while the oil production is coming from 11 ft. into the Massive, the condensate well produced from the second sand stringer above the Massive. Tops for the condensate well were Marine Tuscaloosa 8,589 ft., base Marine Tuscaloosa 8,949 ft., producing sand stringer 9,127 ft., and Massive 9,236 ft. Tops on the oil well are Marine Tuscaloosa 8,543 ft., base Marine Tulsaloosa 8,838 ft., Massive 9,112 ft., and producing depth 9,123 ft. Humble is moving the rig from the 1 Ball well to drill the north offset, Humble 1 E. O. Ball.

MISSISSIPPI WILDCAT FAILURES

Jasper County: Angle & Angle 1 McCollum, NW SW NW 15-2n-10e, dry, TD 7,237 ft., Massive sand 7,176 ft.

Marion County: Gulf 5 Bradshaw, approx. NE NE NE 28-3n-17w, dry, TD 6,828 ft., anhydrite 6,734 ft.

Tate County: C. Porter Johnson 1 Prichard estate, NE NE NW 28-4s-7w, dry, TD 3,165 ft., Eutaw 2,797 ft.

Yazoo County: Skelly 1 Bridgeforth, 2,310 ft. north and 330 ft. west of SE cor. 17-12n-2e, dry, TD 6,716 ft., Comanche 6,543 ft.

Carter 1 Bridgeforth, NW SE 24-12n-1e, dry, TD 5,647 ft., Wilburn sand 5,360 ft.

North Central Texas

(Continued from page 167)

elev. 1,107 ft., Barnett 6,462 ft., Simpson 6,750 ft., Ellenburger 6,941 ft., dry, TD 7,115 ft.

Cooke County: Benson 1 J. B. Pace, E. Yeamans Sur. A-1173, 1 mi. S and W Gainesville, elev. 778 ft., dry, TD 2,468 ft.

Throckmorton County: Lion Oil 1 Frank Daws, Sec. 1694 TE&L Sur., 2 mi. E and 3 mi. N Masters, Mississippian 4,703 ft., Ellenburger 4,860 ft., dry, TD 4,895 ft.

Wichita County: Bridwell Oil 1 H. W. Barton, Sec. 12, AB&M Sur. A-809, 4 mi. E and 2 mi. N Electra, dry, TD 2,071 ft.

Reno Oil 1 Virginia M. Dale, Mary A. Bush Sur. A-24, 6 mi. W and 2 mi. N Clara, elev. 1,057 ft., dry, TD 2,005 ft.

Wilbarger County: G. W. Cooper 1 J. D. Melton, Sec. 15, Blk. 5, H&TC Sur., 6 mi. S and 4½ mi. W Electra, elev. 1,089 ft., Ellenburger 4,560 ft., dry, TD 4,619 ft.

Young County: Lesco 1 Ray E. Davis, Sec. 63, TE&L Sur., 5 mi. W and 1 mi. S Orth, elev. 1,185 ft., Ellenburger 5,027 ft., dry, TD 5,080 ft.

WEST CENTRAL TEXAS WILDCAT FAILURES

Jones County: Alder Oil 1 Mamie Munroe et al, Sec. 98, Blk. 1, BBB&C Sur., 3½ mi. NW Anson, elev. 1,683 ft., Swastika 2,972 ft., dry, TD 4,013 ft.

Eltex, Ltd., 1 J. P. Wooten, Sec. 3, Blind Asylum Land, 7 mi. NE Lanius, elev. 1,699 ft., Strawn 3,425 ft., dry, TD 3,546 ft.

Shackelford County: Eltex 1 Merrick Davis, Sec. 30, Blk. 12, T&P Sur., 6 mi. SE Budmathews, elev. 1,877 ft., Ellenburger 5,109 ft., dry, TD 5,218 ft.

Rocky Mountain Area

(Continued from page 163)

these are wildcats, including the Continental test on the northwest flank of the Rangely field and the Pacific Western in Bent County, both in Colorado, and two in Wyoming, one in East Lance Creek in Fred Manning 1 Government, SW NW SW 28-36n-64w, and the other on the Centennial Dome, Albany County, in Trigood Oil Co. No. 1, NE 5-15n-77w.

Completions. — Seventeen completions were reported, of which eight were in Colorado, five in Wyoming, and four in Montana. Thirteen of these were oil wells with an initial production of 3,588 bbl., of which six for 2,481 bbl. were in Colorado; four for 1,030 bbl. were in Wyoming, and three for 77 bbl. were in Montana. Four were dry holes. Two were wildcats, both failures.

COLORADO WILDCAT FAILURES

Prowers County, East May Valley: Union Oil of California and Richfield Oil 1 Kroell, SE NW NW 27-21s-46w, TD 5,457 ft., dry after testing the Arbuckle, top Permian 1,110 ft., top Pennsylvanian 3,060 ft., top Kansas City lime 3,618 ft.

Moffat County, Great Divide: Ralph M. Parsons Co. 1 Smith, SW SW NW 6-9n-92w, TD 4,565 ft., water at 4,405 ft., dry.

Kentucky Fields

(Continued from page 163)

in Knott County at a total depth of 2,618 ft., with a daily open flow of 381,000 cu. ft. of gas in shale after shot.

Inland Gas Corp. completed No. 272 on the Mattie Davis property in Johnson County at a total depth of 2,386 ft. with a daily open flow of 285,000 cu. ft. of gas from Big Six.

WESTERN KENTUCKY

OWENSBORO, Ky.—Four oil wells, two gas wells and two dry holes comprised Western Kentucky's crop of reported completions in the past week.

WESTERN KENTUCKY WILDCAT COMPLETIONS

Henderson County: Delta Drilling 1 Crutchfield, NE SW NE 4-Q-20, 1 mi. S of Mt. Vernon, Ind., Penn sand 1,060-77 ft. TD 1,881 ft., 1,000,000 cu. ft. gas well, rock pressure 500 lb.

Ashland and Basin 1 Hanley, 16-O-24, 8½ mi. S of Henderson, dry at 2,689 ft. Lower Menard 1,702 ft., Barlow 2,161 ft., Renault 2,340 ft., Ste. Genevieve 2,477 ft.

Farmer & Chenault and Ohio Oil 2 Charles Chinn, 24-P-27, dry at 2,025 ft. Lower Menard 1,238 ft., Barlow 1,660 ft., Cyypess 1,666 ft., Ste. Genevieve 1,851 ft.

Daviess County: Sohio 1 Pressley Sauer, 1-P-27, near Stanley, 250,000 cu. ft. gas well from Waltersburg sand at 1,122-31 ft.

INDIANA

EVANSVILLE, Ind.—After two very quiet weeks in the Indiana fields 12 wells were reported completed in the past week, 5 oil, 2 gas and 5 dry. No wildcats were included in the completions.

Permian Basin

(Continued from page 164)

1 Federal-fee, Ellenburger discovery in the Penrose area of Lea County. It is 8 Greenwood, 1,980 ft. from the south and west lines of 9-22s-37e. Continental Oil Co. 1-B-22 Skaggs, 22-26s-37e, ½ mile northwest outpost to the Skaggs deep pool in Lea County, was drilling below 7,509 ft. in lime.

Eddy County had two field completions this week, one each in Artesia and Red Lake fields. Eddy County reported two new field locations and Lea County one.

SOUTHEASTERN NEW MEXICO WILDCAT FAILURE

Eddy County: A. J. Hardendorf 1 Texas Gulf Producing Co.-State, 2-19s-30e, 3½ mi. NE Benson field, elev. 3,521 ft., Yates 2,100 ft., dry, TD 3,310 ft.

CALENDAR

October

American Association of Oil Well Drilling Contractors, Oklahoma City, October 1-2.

California Natural Gasoline Association, fall meeting, Biltmore Hotel, Los Angeles, October 12.

I.P.A.A., annual membership meeting, Tulsa, October 15, 16 and 17.

American Gas Association, annual meeting, Engineering Societies Building, New York, October 24-25.

November

American Petroleum Institute, annual meeting, Stevens Hotel, Chicago, November 12-15.

Independent Natural Gas Association of America, annual membership meeting, Dallas, November 26.

1946

April

Natural Gasoline Association of America, annual convention, Baker Hotel, Dallas, April 17-19.

AUCTION SALES

H. M. Collins, Auctioneer
AUCTION SALE STOCKS, BONDS, &c.
ADRIAN H. MULLER & SON
NEW YORK CITY OFFICE, 39 BROADWAY
JERSEY CITY OFFICE, 75 Montgomery St.
WEDNESDAY, OCTOBER 10, 1945
at 12:30 O'CLOCK P. M. at the Exchange Salesrooms, 20 Vesey St., N. Y. C.
For Account of Whom It May Concern:
1,922 shs Engineers' Oil Shale Company (Colo) common
217 shs Engineers' Oil Shale Company (Colo) 7% prefd
NOTE: Titles of securities are not representations but are given merely for purposes of identification.